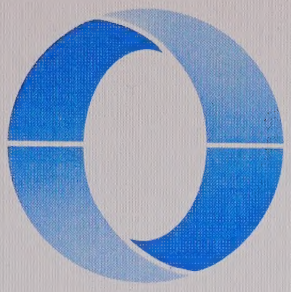

Macbeth
Color &
Photometry
Division

OF KOLLMORGEN CORPORATION

Photographic Color Analyzer PA-905/NB-500PA

Service Manual

SERVICE MANUAL

FOR

PHOTOGRAPHIC ANALYZER,

MODELS NB500-PA/PA-905

SUPER CHROMEGATRON I & II

Macbeth
Color &
Photometry
Division
OF KOLLMORGEN CORPORATION

P.O. BOX 950, NEWBURGH, NEW YORK 12550
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This maintenance/service manual contains the data, descriptions, and specifications of the model described herein as they were in effect at the time the manual was approved for printing. Consistent with the Macbeth Division's policy of continuous product improvement, it is possible that these data, descriptions, and specifications may be changed in the future or that the model described herein may be discontinued. The Macbeth Division of Kollmorgen Corporation reserves the right to make such changes or to discontinue such model without notice. If the model described herein should be significantly changed or discontinued, we will announce such change or discontinuance by means of addenda, change notices, replacement pages, or other similar methods.

CHANGE NO. 1

DATE Feb. 23, 1973

INSTRUCTION BOOK CHANGE NOTICE

MANUAL AFFECTED PA-905 Service Manual (ISSUE DATE: 6/72)

1. Page 3-9. Table 3-3 (Signal/Voltage Measurements)

The first word of the second sentence given in "Test Notes" for Test Point A should be changed from "Convert" to "Connect."

2. Page 3-37. PA-905 Calibration

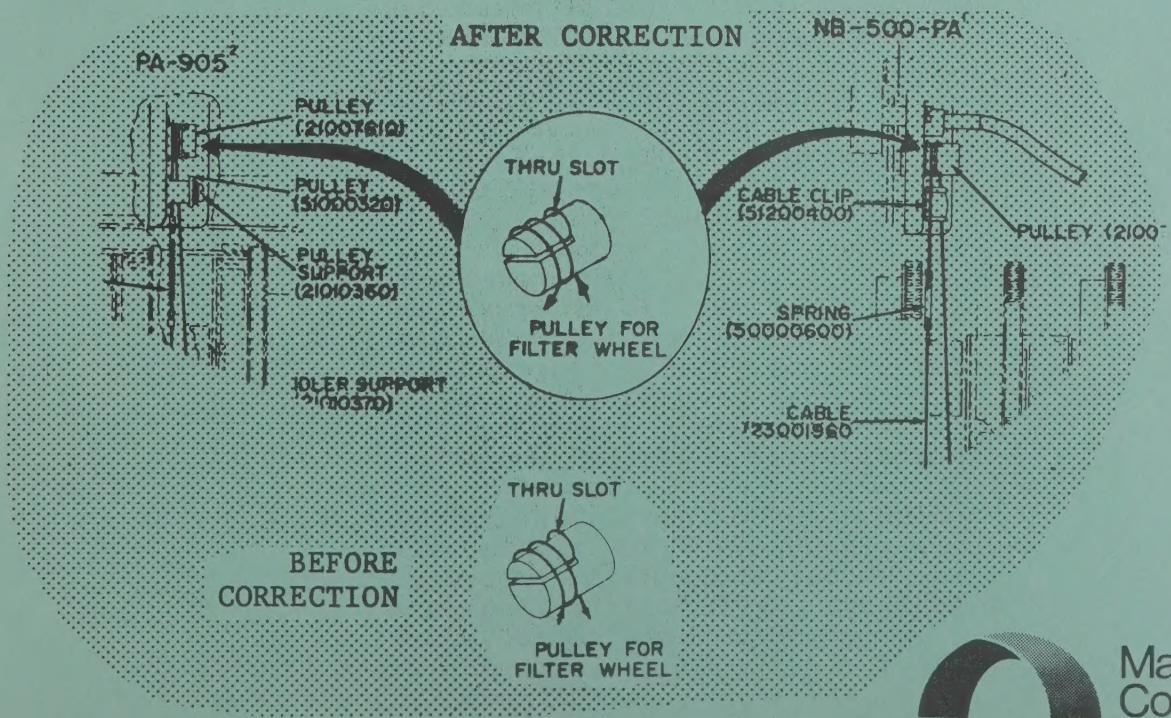
In the second sentence of step 50, change R362 to R326.

3. Page 3-47/3-48. NB-500PA Calibration

Delete steps 48 through 52 in their entirety.

4. Page 5-4. Figure 5-3

Cabling-direction arrows for the filter-wheel pulley should be changed as indicated in the sketch below.



Macbeth Color & Photometry Division

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A. NB-500PA (Super Chromegatron I)

B. PA-905 (Super Chromegatron II)

Figure 1-1. Photographic Analyzer

SECTION 1
GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

Photographic Color Analyzers NB-500PA[1] and PA-905[2] (figure 1-1) are on-easel, colorimetric photometers that sample and measure light energy at various wavelengths in the visible spectrum (see figure 1-2). Measurement of the selected light energy provides indications of: (1) amount of cyan, magenta and yellow filtration (in terms of Kodak CC and CP, or Agfa filters) being used in the enlarger/printer; (2) proper exposure time (in seconds) to be used when making prints.

The Analyzer comprises two units: (1) a photometer housing containing essentially, a center-reading meter, all electronic circuits, light filters and photodetector (i.e. photomultiplier tube); (2) a probe equipped with a tiltable, light-collecting surface that facilitates cosine correction so that optimum optical alignment can be achieved anywhere on an enlarger/printer easel. The probe and the photometer housing are connected by a flexible, non-coherent fiber-optic cable.

1.2 TECHNICAL SPECIFICATIONS

Technical specifications for the Analyzer are as follows:

a. Optical System:

Probe:	Small probe with flexible fiber-optic cable pipes (i.e. channels) incident light to photomultiplier tube located in main housing. Rotatable fiber-optic barrel contained in probe provides cosine correction so correct optical alignment can be maintained anywhere on enlarger easel.
Filters:	Filter wheel located in main housing contains four filter positions equipped with filters (listed below) for evaluating color balance and exposure time. Appropriate filter is inserted in optical path via front-panel selector switch. Colored lamp which matches (or compliments [1] & [2]) filter in use illuminates dial of corresponding front-

[1]Super Chromegatron I
[2]Super Chromegatron II

1-2. TECHNICAL SPECIFICATIONS (Cont.)

panel attenuator.

Attenuator Position		Filter Wratten #
NB-500PA PA-905	Super Chromegatron I/II	
Red	Cyan	92
Green	Magenta	99
Blue	Yellow	47B
White*	White*	96
*Neutral Density		

(See Fig. 1-2)

b. Meter Scale: Divided into two separate scales: (1) Exposure time—direct-reading scale; easy-to-read divisions from 1 to 100 seconds increasing from left to right. (2) Correction-Filter-Requirements—scale is divided into 6 major divisions (0.1, 0.2, 0.4, 0.6, 0.8, 1.0) on either side of center-reading Null area; each 0.1 division can be interpreted as being approximately equal to a Kodak CC10 filter; meter markings clearly indicate whether filtration should be added or removed.

c. Input Power: 115/230 vac., 50/60 Hz., single phase, 0.130/.065 amp., approximately 17 watts.

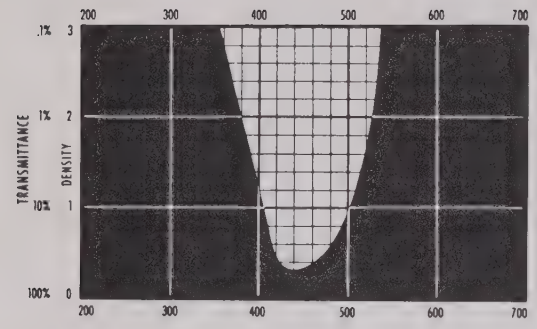
d. Voltage Regulation: Fully transistorized power supply with built-in comparator circuit provides regulated operating voltages. Normal line-voltage variations will not affect performance of instrument.

e. Dimensions:

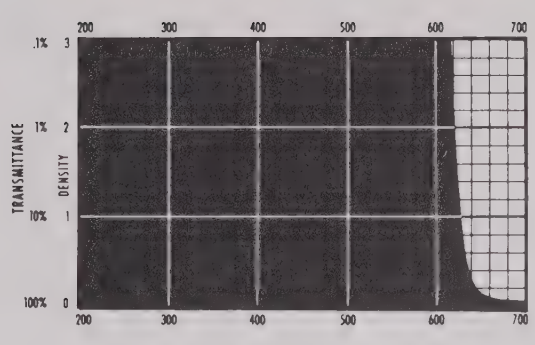
Photometer: 12 inches (30.5cm) long; 7-1/8 inches (18.2cm) high; 8 inches (20cm) wide

Probe: 3-5/16 inches (8.44cm) long; 1 inch (25.4cm) high; 2-1/8 inches (5.4cm) wide.

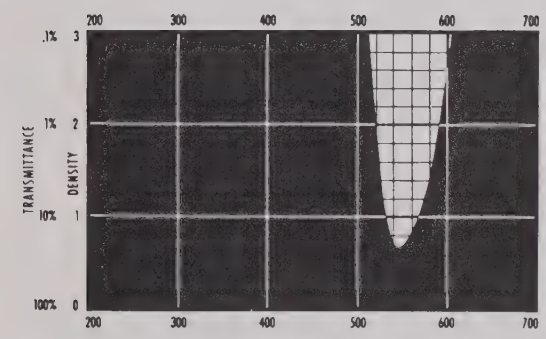
f. Weight: Net weight: 13 lbs. (5.85kg)
Shipping weight: 21 lbs. (9.45kg)



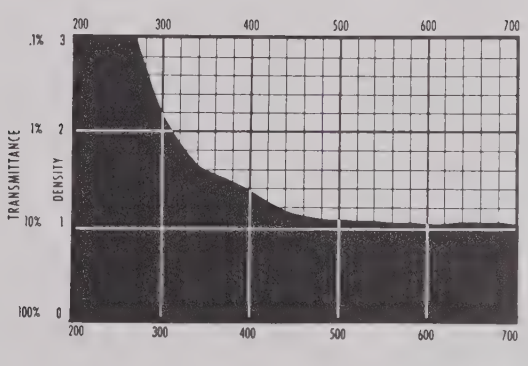
47 Blue



92 Red



99 Green



96 Neutral Density

NOTE

Overall instrument response is determined by: (1) filter characteristics; (2) photo-multiplier response; (3) optical geometry of the in-strument; (4) instrument electronics.

Figure 1-2. Filter Characteristics

SECTION 2
INSTRUMENT ANALYSES

2.1 CIRCUIT ANALYSIS (Refer to Figure 2-1)

The Analyzer comprises nine basic sections: a Photomultiplier Assembly, an AC Amplifier stage, a Precision AC to DC Converter, a Comparison Amplifier, a DC to DC Converter, a Compensating Circuit, an Attenuating Network, a Metering Circuit, and a Regulated Power Supply.

Operation of the electronic circuitry is based upon the use of a photomultiplier in a feedback circuit that automatically adjusts the dynode voltage applied to the photomultiplier so as to maintain constant anode current. The dynode voltage required to maintain a constant, pre-set anode current for any particular amount of light falling upon the photosensitive cathode is used as a measure of the optical density of a sample placed between a light source and the photomultiplier itself (i.e. density of a negative placed in an enlarger).

Light flux striking the probe is transmitted via fiber optics to the photomultiplier assembly. Within the photomultiplier assembly, the incident light flux is attenuated by one of four filters (figure 1-2) and then converted to a pulsating d-c signal at approximately 100 cps. This signal, the magnitude of which is directly proportional to incident light flux, is extended through Q301 (an impedance matching device), is amplified (by operational amplifier Q302A) to 4.0 volt P-P, and is then applied to a precision 2-stage a-c to d-c converter (Q302A and Q303A). The output of this stage (-1.75 vdc $\pm$ potential difference due to change in photomultiplier anode current as a result of increase of decrease in incident light flux) and a highly stable -1.75 vdc reference signal are simultaneously applied to a comparator circuit (Q304 and Q305). Any difference between the two nominally identical signals causes a correction voltage to be developed and amplified by Q306 and Q307 (configured as an emitter follower) and then used to drive a saturable-core square wave oscillator (Q101, Q102, and T101) located in the DC to DC Converter Stage. The oscillator output (25Kc, 0-500 volts peak) is then rectified and doubled and applied as dynode voltage to the photomultiplier.

A sample of the dynode voltage is extended via compensating and attenuator networks to meter amplifier Q303B which in turn provides the input signal for meter M501. Depending upon the position of switch S503, the gain of meter amplifier Q303B is set for exposure-time or density indications.

2.2 OPTICAL SYSTEM ANALYSIS

The Analyzer employs an optical system in which light flux falling upon a probe is channelled via fiber optics to a light-tight chamber

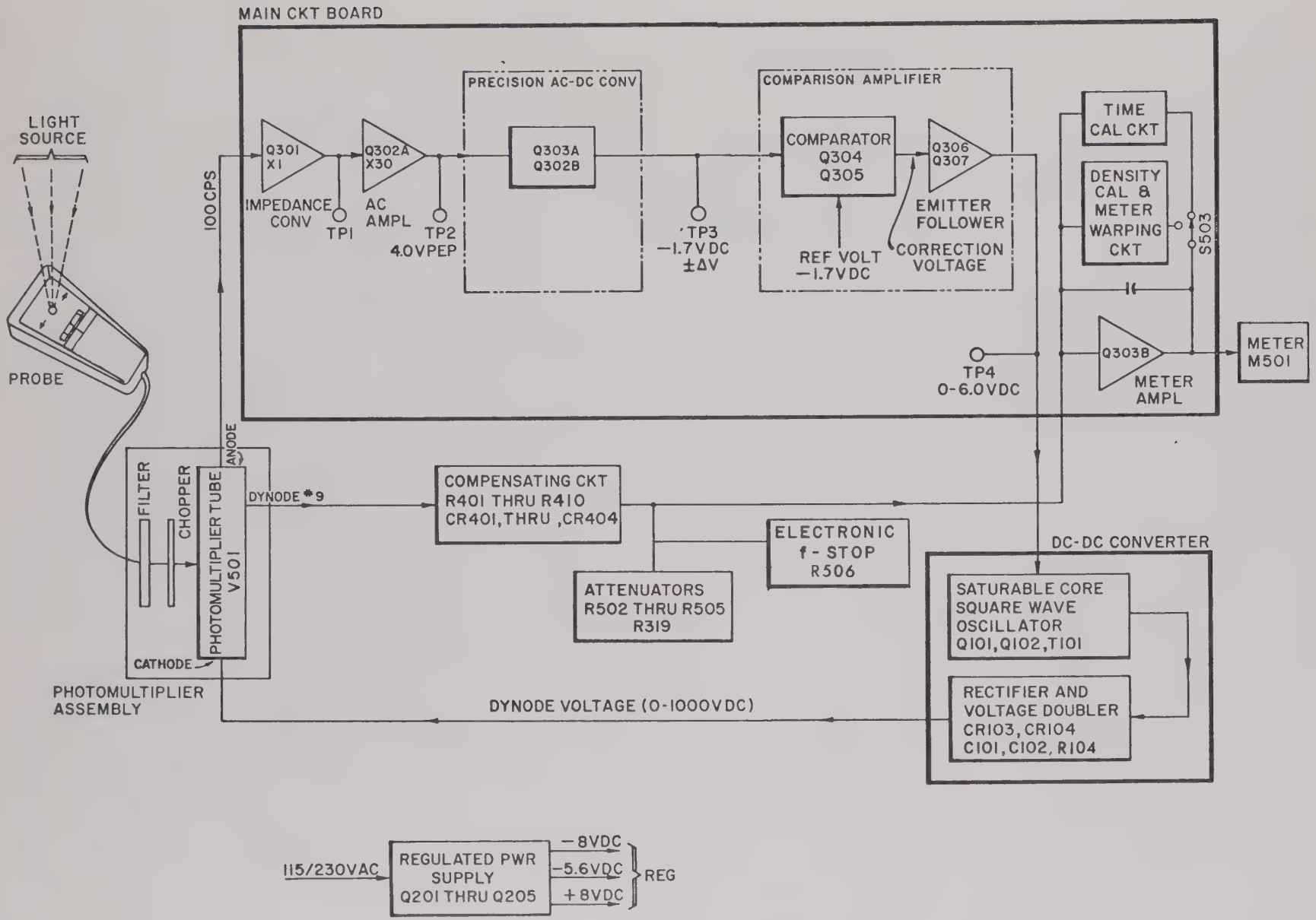


Figure 2-1. System Block Diagram

(photomultiplier housing) wherein the incident light flux is: (1) interrupted at approximately 100 cps via a chopper motor; (2) attenuated by color filters or by a neutral density filter; (3) focused onto the cathode of a photomultiplier tube by two equi-convex lenses.

A rotatable Fiber-Optic Barrel located in the instrument probe (figure 2-2) enables cosine correction so that optimum optical alignment can be achieved anywhere on the enlarger easel. Light flux striking the probe is piped (via total internal-reflection phenomena) through a flexible, non-coherent fiber-optic bundle (i.e. cable) to an aperture in the photomultiplier housing. Interposed between this aperture and a filter wheel, a chopper blade (detail B, figure 2-2) mounted on the shaft of a non-synchronous, shaded-pole, 3000 rpm, self-induction motor interrupts the light path to provide an approximate 100 cps light-beam signal. This signal is then attenuated by one of four selectable filters mounted in the filter wheel.

The interrupted light beam is subsequently passed through one equi-convex lens and then another thus focusing the 100 cps light-beam signal on the cathode of photomultiplier V501.

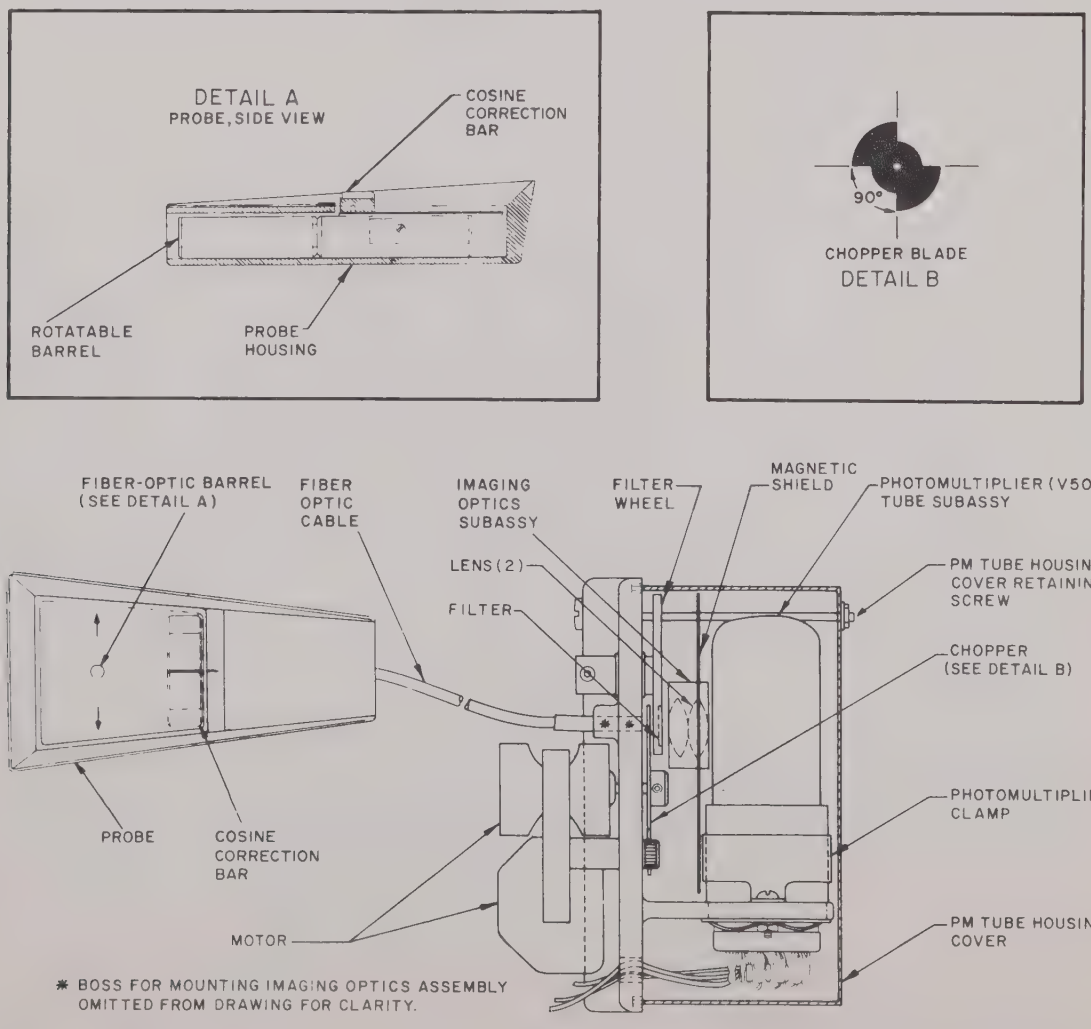


Figure 2-2. Optical System, Pictorial Diagram

SECTION 3
MAINTENANCE

3.1 INSPECTION/CLEANING

NOTE

Improper care will sometimes manifest itself in actual or potential trouble conditions. The analyzer should be thoroughly inspected and cleaned whenever it is returned for service and/or repair.

1. Ensure that linecord of Analyzer is disconnected from a-c power source. Remove probe from probe cradle and set probe aside. Carefully set instrument on its left side (i.e. side without probe cradle); loosen and remove four corner screws (see figure 3-1) securing instrument cover to chassis.

2. Set instrument upright. Using #8 Allen wrench, loosen two setscrews securing knob of Selector switch to shaft; remove knob.

WARNING

Once the instrument cover is removed (step 3 below), a possibility of electric shock exists if input power has not been disconnected from the Analyzer.

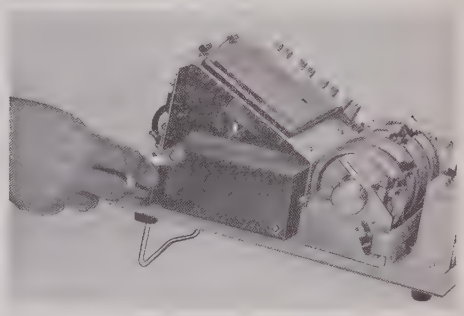
3. Carefully lift instrument cover from chassis and set cover aside. Inspect wiring and all components for dust, dirt, moisture, corrosion, discoloring or grease. Inspect also for loose connections; resolder or tighten connections as required (pay particular attention to instructions given in paragraph 3.3.7). Dust should be removed with a soft brush or vacuum cleaner; dirt or grease should be removed from all components except the P/C boards with any suitable cleaning solvent. P/C boards should be cleaned only with a dry brush.

CAUTION

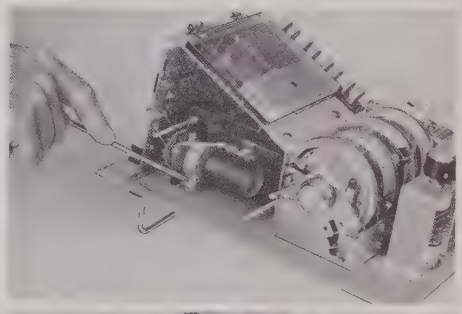
Carbon Tetrachloride is highly toxic; its use should be avoided. Trichlorethylene has paint-removing qualities; do not use on painted surfaces.

CAUTION

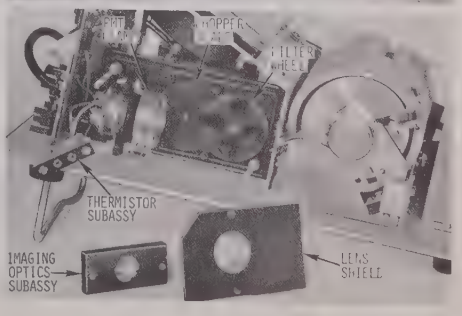
When using toxic solvents make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Do not use flammable solvents on energized equipment from which a spark may be received. Smoking, "hot work", etc., should be prohibited in the immediate area.

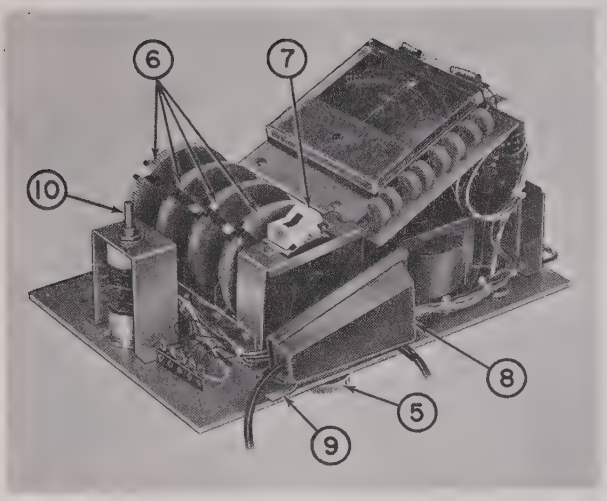


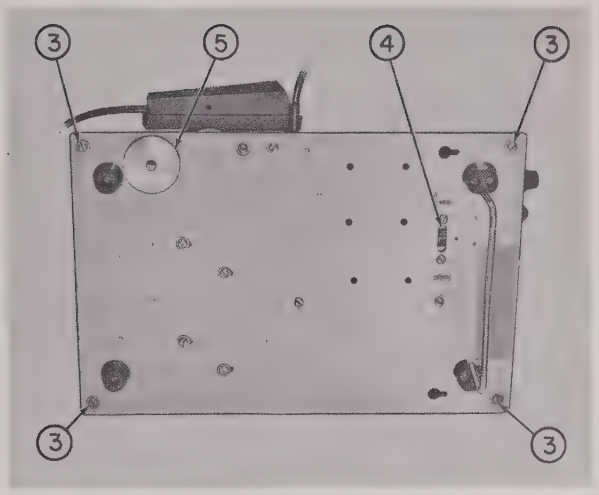
4. Loosen and remove two nuts securing photomultiplier housing cover; remove cover and set it aside.

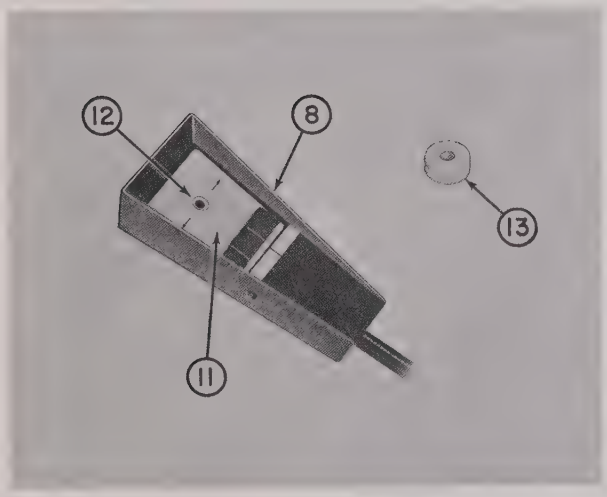


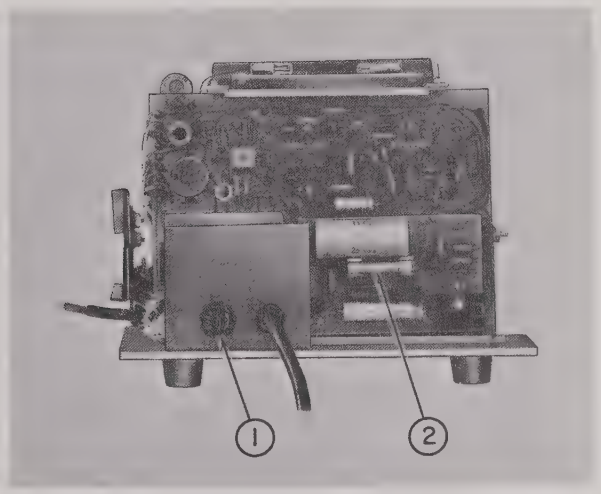
5. Loosen photomultiplier tube clamp and carefully pull photomultiplier tube from socket. Loosen and remove two screws securing lens shield, thermistor subassembly and imaging optics subassembly to supports; carefully remove lens shield, thermistor subassembly and imaging optics assembly from supports. Inspect photomultiplier tube, imaging optics subassembly and filters for damage and accumulation of dirt or dust. Clean tube, filters and imaging optics subassembly with lens brush. Inspect thermistor subassembly for broken or loose connections; resolder connections as required.











1. Fuse F501
2. Fuse F201
3. Cover Retaining Screws
4. 115/230 vac Switch
5. Electronic f-Stop
6. Attenuators
7. On/Off Switch
8. Probe
9. Attenuator Brake (PA-905 and Super Chromegatron II only).
10. Selector Switch
11. Target Plate
12. Reading Area Insert
13. Auxiliary Lens (PA-905 and Super Chromegatron II only)

Figure 3-1. Component Location

6. Reassemble all components in reverse order of disassembly (steps 1 through 5 above). When replacing photomultiplier tube, take care that the tube is seated properly in socket.

7. Inspect reading area of instrument probe for accumulation of dirt or dust; clean reading area with lens brush or lens tissue.

NOTE

If analyzer is to be returned to service after inspection and cleaning, it should be re-indexed for all printing conditions.

3.2 TROUBLESHOOTING

NOTE

If the analyzer has been performing satisfactorily and suddenly fails, the cause of failure may be apparent through circumstances occurring or existing at the time of failure. Ascertaining the circumstances at the time of failure may eliminate the need for further troubleshooting.

3.2.1 GENERAL

Table 3-1 is provided as a guide for isolating the more obvious malfunctions that may occur. If the reason for equipment malfunction is not obvious and the faulty component cannot be isolated via use of the information given in table 3-1, proceed with point-to-point signal/voltage measurements outlined in paragraph 3.2.3.

CAUTION

Signal/voltage measurements and component replacement procedures should be attempted only by experienced technicians as extensive damage can result from improper testing/workmanship.

3.2.2 TEST EQUIPMENT REQUIRED

Table 3-2 lists all test equipment required to troubleshoot, align or calibrate the analyzer.

3.2.3 SIGNAL/VOLTAGE MEASUREMENTS

Table 3-3 provides discrete signal/voltage measurements for each major stage of the Analyzer. Appropriate test points are illustrated in figures 4-13, 4-14, 4-15, 5-1 and 5-2. Coupled with the circuit-analysis information provided in Section 2 of this manual, these signal/voltage measurements will facilitate the task of troubleshooting the Analyzer. Any significant deviation from values given in Table 3-3 should indicate (and help to isolate) the probable cause of trouble.

Table 3-1. PRELIMINARY TROUBLESHOOTING GUIDE

TROUBLE INDICATION	VERIFICATION OF TROUBLE	PROBABLE CAUSE
1. Meter lamps and dial lamps do not light and readings cannot be obtained when On/Off switch is set at either of two "On" positions.	a. ————	Defective On/Off switch (refer to paragraph 3.3.9)
	b. Fuse F401 blown analyzer functions properly when fuse is replaced. CAUTION Do not replace a fuse with one of higher rating (see Table 3-4). If a fuse blows immediately after replacement, do not replace it a second time until the trouble has been located and corrected (see entry "c" and "d" below.)	Temporary power surge or overload (refer to paragraph 3.3.1).
	c. Fuse F401 blown. Replacement fuses blow until brown wire is removed from chopper motor.	Defective chopper motor (refer to paragraph 3.3.5).

Table 3-1. PRELIMINARY TROUBLESHOOTING GUIDE (Cont.)

TROUBLE INDICATION	VERIFICATION OF TROUBLE	PROBABLE CAUSE
1. cont.	d. Fuse F401 blown. Replacement fuses blow even though brown wire is removed from chopper motor.	Short circuit in analyzer circuitry (refer to paragraph 3.2.3)
2. Meter lamps and dial lamps light but meter is pegged downscale (i.e. to left side of meter).	a. Adjustment of attenuators or electronic f-stop have no effect on meter.	Fuse F201 blown (refer to paragraph 3.3.1).
3. Meter indicates to the right of center NULL area and analyzer has little or no sensitivity to light	a. Refer to Table 3-3. Measure: (1) high dynode voltage (at HV test point); (2) no signal at TP1.	Defective chopper motor (refer to paragraph 3.3.5). Defective fiber-optic cable (refer to paragraph 3.3.17). Defective photomultiplier tube (refer to paragraph 3.3.3). Defective transistor (FET) Q301 (refer to paragraph 3.3.7.1).
	b. Refer to Table 3-3. Measure low dynode voltage.	Defective meter (refer to paragraph 3.3.8). Defective amplifier Q303B, diode CR304 or diode CR305 (refer to paragraph 3.3.7.1).
	c. Refer to Table 3-3. Measure: (1) high dynode voltage at TP2. Signal at TP1 is OK.	Defective amplifier Q302A* or resistor R306, (refer to paragraph 3.3.7.1). Defective CALIBRATE Potentiometer R501 (NB-500PA only--refer to paragraph 3.3.13).
* Q302 and Q303 are plug-in components.		

Table 3-1. PRELIMINARY TROUBLESHOOTING GUIDE (Cont.)

TROUBLE INDICATION	VERFICIATION OF TROUBLE	PROBABLE CAUSE
3. cont.	d. Refer to Table 3-3. Measure: (1) high dynode voltage (at HV test point); (2) incorrect voltage at TP3 and TP4 Signal at TP1 and TP2 is OK.	Defective amplifier Q302B* or Q303A* or diode CR302 or CR303 (refer to paragraph 3.3.7.1).
	e. Refer to Table 3-3. Measure: (1) high dynode voltage (at HV test point); (2) incorrect voltage at TP4. Signal at TP1, TP2 and TP3 is OK.	Defective amplifier Q304, Q305, Q306 or Q307 (refer to paragraph 3.3.7.1).
	f. Refer to Table 3-3. Measure: (1) high dynode voltage (at HV test point); (2) signal at TP1, TP2, TP3 and TP4 is OK.	Defective DC-DC Converter (refer to paragraph 3.3.7.3).
4. Meter indicates to the left of center NULL area.	a. Refer to Table 3-3. Measure high dynode voltage (at HV test point).	Defective meter (refer to paragraph 3.3.8).
		Defective amplifier Q303B*, diode CR304, or diode CR305 (refer to paragraph 3.3.7.1).
	b. Refer to Table 3-3. Measure: (1) low dynode voltage (at HV test point); (2) signal at TP1, TP2, TP3 and TP4 is OK.	Defective DC-DC Converter (refer to paragraph 3.3.7.3).
	c. Refer to Table 3-3. Measure: (1) low dynode voltage (at HV test point); (2) incorrect signal at TP3 and TP4 Signal at TP1 and	Defective amplifier Q302B* or Q303A* or diode CR302 or CR303 (refer to paragraph 3.3.7.1).

* Q302 and Q303 are plug-in components

Table 3-1. PRELIMINARY TROUBLESHOOTING GUIDE (Cont.)

TROUBLE INDICATION	VERIFICATION OF TROUBLE	PROBABLE CAUSE
4. cont.	TP2 is correct.	
	d. Refer to Table 3-3. Measure: (1) low dynode voltage (at HV test point); (2) incorrect signal at TP2, TP3, and TP4. Signal at TP1 is OK.	Defective amplifier Q302A* or resistor R306 (refer to paragraph 3.3.7.1).
	e. Refer to Table 3-3. Measure: (1) low dynode voltage (at HV test point); (2) correct signal at all other test points.	Defective photomultiplier housing cover. Stray light reaching photomultiplier tube.

* Q302 and Q303 are plug-in components.

Table 3-2. REQUIRED TEST EQUIPMENT

TEST EQUIPMENT	PURPOSE	REQUIRED SPECIFICATIONS	RECOMMENDED INSTRUMENT
1. Digital Voltmeter	Point-to-point voltage measurements (Table 3-3)	Input Impedance greater than 20,000 ohm/volt	Fairchild Model 7050 or equivalent
2. Oscilloscope	Signal/voltage measurements (Table 3-3)		Tektronix, Model 516A or equivalent
3. VTVM	Point-to-point voltage measurements (Table 3-3)	Input Impedance greater than 20,000 ohm/volt	Hewlett Packard, Model 410B or equivalent
4. Standardized Light-Source/ Filtration Unit	Signal/voltage measurements (Table 3-3) Alignment/ Calibration Procedure (paragraph 3-4)		Macbeth Color Calibration Unit (Part No. 29002650) Model CACU or equivalent

Table 3-3. SIGNAL/VOLTAGE MEASUREMENTS

TEST POINT	RELATED ILLUSTRATIONS	TEST NOTES	NORMAL INDICATION
	WARNING For the most part, the Analyzer operates on low voltage. Nevertheless, precaution should be taken to minimize the possibility of electric shock during the following measurements.		
A	Figure 4-15, 5-1, 5-2	Arrange VTVM or digital voltmeter for + dc voltage measurements. Convert test probes to "A" and chassis ground.	+8 ± .2 vdc
B	Figure 4-15, 5-1, 5-2	Arrange VTVM or digital voltmeter for - dc voltage measurements. Connect test probes to "B" and chassis ground.	-5.6 ± .2 vdc
C	Figure 4-15, 5-1, 5-2	Arrange VTVM or digital voltmeter for - dc voltage measurements. Connect test probes to "C" and chassis ground.	-8 ± .3 vdc
TP1	Figure 4-13, 5-1, 5-2	Connect oscilloscope to TP1 and chassis ground. Adjust scope for 5u sec/cm. time base. Analyzer probe should be in its cradle.	
TP2	Figure 4-13, 5-1, 5-2	Connect oscilloscope to TP2 and chassis ground. Adjust scope for 5u sec/cm. time base. Analyzer probe should be in its cradle.	
TP3	Figure 4-13, 5-1, 5-2	Arrange VTVM or digital voltmeter for - dc voltage measurements. Connect test probes to TP3	-1.7 ± .1 vdc for units where R317 (see figure 4-13) is

Table 3-3. SIGNAL/VOLTAGE MEASUREMENTS (Cont.)

TEST POINT	RELATED ILLUSTRATIONS	TEST NOTES	NORMAL INDICATION
TP3 (cont)		and chassis ground. Analyzer probe should be in its cradle.	2.2 Kohms. -1.5 ± .1 vdc for units where R317 (see figure 4-13) is 2.67 Kohms.
TP4	Figure 4-13, 5-1, 5-2	Arrange VTVM or digital voltmeter for + dc voltage measurements. Connect test probes to TP4 and chassis ground. PA-905[2] Analyzer probe should be in its cradle. NB-500PA[1] Analyzer probe should be in its cradle; Filter Selector should be set at white (exposure) attenuator; meter should indicate NULL.	 +4 to +7 vdc +3 ± .5 vdc
HV	Figure 4-13, 4-14, 5-1, 5-2	Arrange VTVM for - dc voltage measurements. Analyzer probe should be in probe holder for Color Analyzer Calibration Unit, Filter Selector Switch of Analyzer should be set at Blue Attenuator position. PA-905[2] Connect test probes of VTVM to HV test point and chassis ground. Set upper filter wheel of CACU at gold and lower filter wheel at yellow.	 -200 to -310 vdc

[1]Super Chromegatron I
[2]Super Chromegatron II

Table 3-3. SIGNAL/VOLTAGE MEASUREMENTS (Cont.)

TEST POINT	RELATED ILLUSTRATIONS	TEST NOTES	NORMAL INDICATION
HV cont.		NB-500PA[1] Connect test probes to VTVM to DYNODE jacks located on rear panel of NB-500PA. Set calibrate potentiometer of NB-500PA full cw. Set upper filter wheel of CACU at white and lower filter wheel at yellow.	-250 to -290 vdc

[1] Super Chromegatron I

3.3 COMPONENT REPLACEMENT PROCEDURES

WARNING

To avoid the possibility of electric shock, all replacement procedures should be performed with input power disconnected from the Analyzer.

3.3.1 FUSE REPLACEMENT

There are two fuses employed in the analyzer: (1) fuse F501 located on the rear chassis panel of the instrument; (2) fuse F201 located on the printed circuit board for the power supply. No special instructions are required to replace either fuse, however, in order to gain access to fuse F201, it is necessary to first remove the instrument cover (refer to steps 1, 2, and 3 of paragraph 3.1). Replacement fuses must comply with the information given in Table 3-4.

CAUTION

Do not replace a fuse with one of higher rating. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been located and corrected.

Table 3-4. FUSE-REPLACEMENT DATA

FUSE	RATING	DESCRIPTION
F501 -110 vac Operation	1/4 amp 250 V	#3AG, 1/4 in (6mm) x 1-1/4 (32mm), cartridge, Slo-Blo (Macbeth Part No. 31002000)
-220 vac Operation	1/8 amp 250 V	Same as above (Macbeth Part No. 31002000)
F201	1.0 amp 250 V	Same as above (Macbeth Part No. 31010000)

3.3.2 LAMP REPLACEMENT

3.3.2.1 REPLACING METER LAMP

1. Ensure that Analyzer is disconnected from a-c input power. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1, if necessary).

2. Using long-nose pliers or tweezers, carefully lift lamp from socket; meter lamp is "midget grooved" type and no twisting action is required.

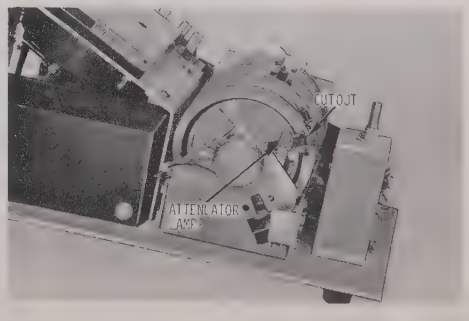
3. Place new lamp in socket and apply slight pressure to seat lamp in socket.

4. Reassemble instrument cover and chassis in reverse order of disassembly.

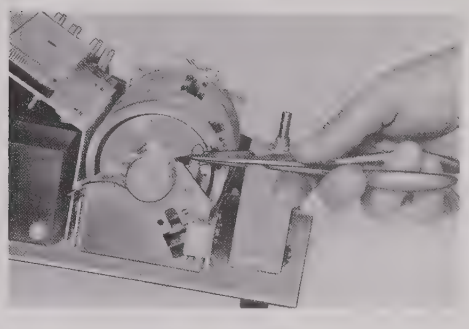
3.3.2.2 REPLACING ATTENUATOR LAMP

1. Ensure that Analyzer is disconnected from a-c input power. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1, if necessary).

2. Rotate attenuator with burned-out lamp to point where cut out of plastic dial is positioned over lamp.



3. Using long-nose pliers or tweezers, carefully lift colored lamp cap off of lamp; lamp cap is held in place by force fit. Set cap in safe place.



4. With long-nose pliers or tweezers, lift lamp out of socket; lamp is "midget grooved" type and no twisting action is required.

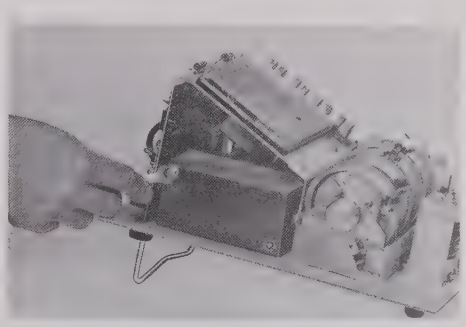
5. Place new lamp in socket and apply light force to seat lamp in socket. Replace colored lamp cap.

6. Reassemble instrument cover and chassis in reverse order of disassembly.

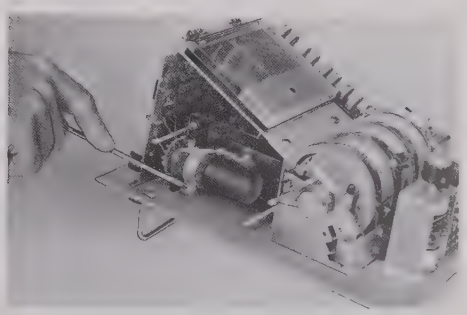
3.3.3 REPLACING PHOTOMULTIPLIER TUBE

1. Ensure that Analyzer is disconnected from a-c input power source. Remove instrument cover from chassis (refer to steps 1, 2, and 3 paragraph 3.1 if necessary).

2. Loosen and remove two nuts securing photomultiplier housing cover; remove cover and set it aside.



3. Loosen photomultiplier tube clamp and carefully pull photomultiplier tube from socket.



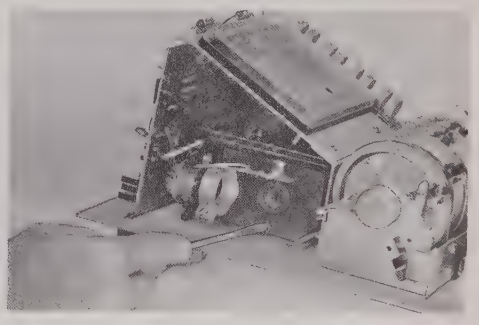
4. Place new photomultiplier tube in socket, tighten tube clamp, and replace photomultiplier housing cover. Recalibrate Analyzer as described in paragraph 3.4. Reassemble Analyzer in reverse order of disassembly.

3.3.4 REPLACING FILTER WHEEL

1. Ensure that Analyzer is disconnected form a-c input power and remove instrument cover from chassis (refer to steps 1, 2, and 3 of paragraph 3.1 if necessary).

2. Remove photomultiplier tube from photomultiplier housing (refer to steps 3 and 4 of paragraph 3.3.3, if necessary).

3. Loosen and remove two screws securing lens shield, thermistor subassembly and imaging optics subassembly to supports. Carefully remove lens shield, thermistor subassembly and imaging optics subassembly from photomultiplier housing.



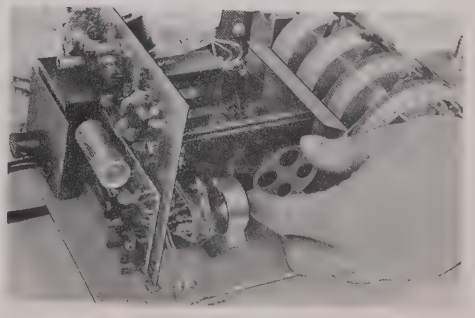
4. Remove Meter Assembly (refer to steps 3 and 4 of paragraph 3.3.8 if necessary). Replace knob on shaft of Filter Selector Switch. Set Selector Switch as follows:

MODEL	SELECTOR SWITCH POSITION
PA-905	Blue Attenuator
NB-500PA	Red Attenuator

5. Using #6 Allen wrench loosen setscrew securing pulley to shaft of filter wheel.

6. Remove pulley with drive cable from shaft of filter wheel; take care not to tangle drive cable.

7. Pull filter wheel out of photomultiplier housing.



8. Install new filter wheel, remount pulley (with drive cable) to shaft of filter wheel (see figure 5-3 for drive cable scheme if necessary).

9. Operate Filter Selector Switch and make certain that drive cable is functioning properly and that filter wheel indexes properly. Remove knob from shaft of Selector Switch.

10. Reassemble Analyzer in reverse order of disassembly.

3.3.5 REPLACING CHOPPER MOTOR

1. Ensure that Analyzer is disconnected for a-c input power (refer to steps 1, 2, and 3 if necessary) and remove instrument cover.

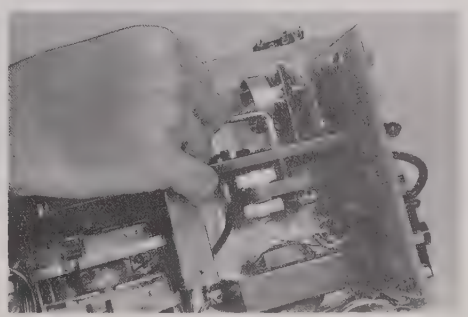
2. Remove photomultiplier tube from photomultiplier housing (refer to steps 3 and 4 of paragraph 3.3.3 if necessary).

3. Remove lens shield, thermistor subassembly and imaging optics subassembly form photomultiplier housing (refer to step 3 of paragraph 3.3.4 if necessary).

4. Remove Meter Assembly (refer to steps 3 and 4 of paragraph 3.3.8 if necessary). Using 30 watt soldering iron, disconnect motor leads from 115/230 Switch S502.

5. Using #6 Allen wrench, loosen set-screw securing chopper blade to shaft of chopper motor.

6. Using #10 Allen wrench, loosen and remove two motor mount cap screws. Remove chopper motor from photomultiplier housing; set motor aside. Chopper blade will slip off motor shaft as motor is removed.



7. Hold chopper blade in position (shaft of new motor should slip into hub of chopper blade) and install new motor. Tighten motor mount cap screws and setscrew on chopper blade.

3.3.6 REPLACING DRIVE CABLE (Refer to Figure 5-3)

1. Ensure that Analyzer is disconnected from a-c input power and remove instrument cover from chassis (refer to paragraph 3.1, if necessary).

2. Remove Meter Assembly (refer to steps 3 and 4 of paragraph 3.3.8 if necessary). Replace knob on shaft of Filter Selector Switch. Set Selector Switch as follows:

MODEL	SELECTOR SWITCH POSITION
PA-905	Blue Attenuator
NB-500PA	Red Attenuator

3. Remove pulley with drive cable from shaft of filter wheel (refer to steps 5 and 6 of paragraph 3.3.4 if necessary). Disengage drive cable from pulley.

4. Using long-nose pliers or tweezers, separate tension spring and drive cable. Set spring aside.

5. Loosen (do not remove) screw securing drive cable to drive pulley.

6. Remove old drive cable, and install new cable in accordance with cabling scheme provided in figure 5-3.

7. Connect each end of drive cable to one end of tension spring.

8. Tighten screw on drive pulley. Remount other pulley on shaft of filter wheel and tighten setscrew.

9. Operate Filter Selector Switch and make certain that drive cable is functioning properly.

10. Remove photomultiplier tube, lens shield, thermistor subassembly and imaging optics subassembly from photomultiplier housing (refer to steps 1, 2 and 3 of paragraph 3.3.4). Make certain that filters index properly when Filter Selector Switch is rotated. Remove knob from shaft of Selector Switch.

11. Reassemble Analyzer in reverse order of disassembly.

3.3.7 REPLACING PRINTED CIRCUIT (P/C) BOARDS OR P/C BOARD COMPONENTS

3.3.7.1 GENERAL

When trouble has been isolated to a P/C board (or if a P/C board is suspected to be defective), return of the instrument to service can, in most cases, be facilitated by replacing the entire P/C board (see note at beginning of paragraph 3.3.7.2). To accomplish this

proceed as described in paragraphs 3.3.7.2, 3.3.7.3 or 3.3.7.4 below.

CAUTION

Extensive damage to the instrument can result from improper workmanship. Only experienced technicians should attempt repair/replacement of P/C board components.

P/C board components can be replaced as individual items; however, their replacement requires complete realignment and recalibration of the instrument (paragraph 3.4).

If any of the components of the P/C board are replaced, it is important to use replacement parts that have the same (or better) performance parameters as the original part. Therefore, it is imperative to refer to the parts list (Section 6) of this manual when ordering replacement parts.

Soldering techniques used when replacing components are, for the most part, conventional; however, particular attention should be paid to the following:

1. A pencil-type soldering iron of 30 watts or less should be used.

2. A solder-absorbing material such as "Soder Wick" (a product of Solder Removal Co., Covina, Calif.) should be used to clean the eyelets of the P/C board.

3. Considerable care must be exercised to avoid overheating the solder point and causing an "open" in the circuitry.

4. Considerable care must be exercised to keep solder from flowing onto an adjacent strip and causing a short circuit.

5. The protective coat on the P/C board will tend to dissolve with soldering heat. The area that has been soldered and the immediate surrounding area should be cleaned with isopropyl alcohol and recoated (sprayed) with Uralane 8267 (a product of Furance Corp., Fairfield, N.J.) or equivalent.

3.3.7.2 REPLACING MAIN CIRCUIT P/C BOARD (Refer to Figure 4-13)

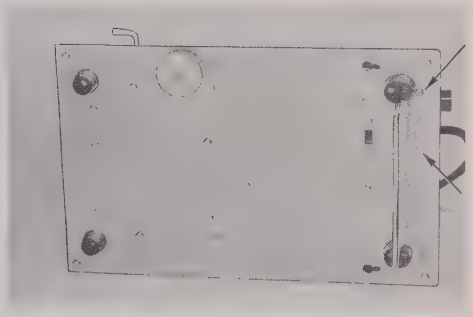
NOTE

Main Circuit P/C Boards for the NB-500PA are no longer available as replacement parts. Defective P/C boards should be returned to the factory for repair.

1. Ensure that Analyzer is disconnected from a-c input power.

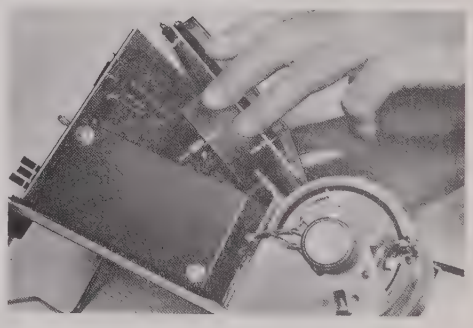
2. Remove instrument cover from chassis (refer to steps 1, 2, and 3 of paragraph 3.1 if necessary). For PA-905[2] proceed to step 3; for NB-500PA[1] proceed directly to step 4.

3. For PA-905[2] only, loosen and remove two screws securing Power Bracket Assembly to chassis. Set Power Bracket Assembly aside. Proceed to step 4.

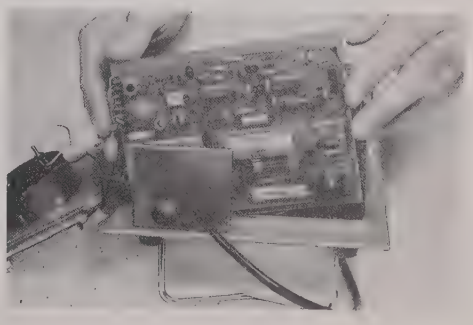


4. Loosen and remove two screws securing meter assembly to meter mounting bracket.

5. Carefully lift meter assembly from mounting bracket and Main Circuit Board. Main Circuit Board is held to Meter Assembly by spring clip and will pull free with slight pressure. Take care not to strain connecting wires and set meter assembly aside.



6. Pull Main Circuit Board free of chassis. Main Circuit Board is held to chassis by spring clip and will pull free with slight pressure.



1 Super Chromegatron I
2 Super Chromegatron II

CAUTION

When performing step 7 below, lable each wire before it is disconnected; this will help to insure that the new Main Circuit Board is wired properly when installed.

7. Unsolder and remove all wires connected to Main Circuit Board.

8. Refer to step 3 of paragraph 3.3.7.3 and remove DC-DC Converter Board from Mail Circuit Board.

9. Refer to step 3 of paragraph 3.3.7.4 and remove Power Supply Board from Main Circuit Board

10. Remount DC-DC Converter Board and Power Supply Board to new Main Circuit Board. Reconnect all wires disconnected in step 7 above.

11. Remount Main Circuit Board on chassis. Replace meter assembly on meter mounting bracket and on Main Circuit Board.

12. Recalibrate Analyzer as described in paragraph 3.4.

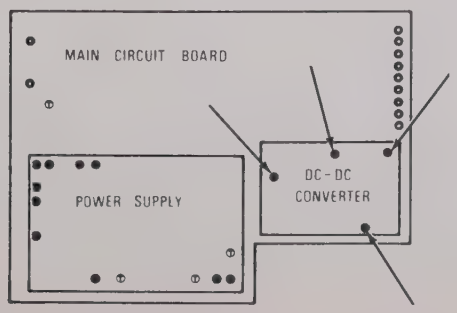
13. Reassemble Analyzer in reverse order of disassembly.

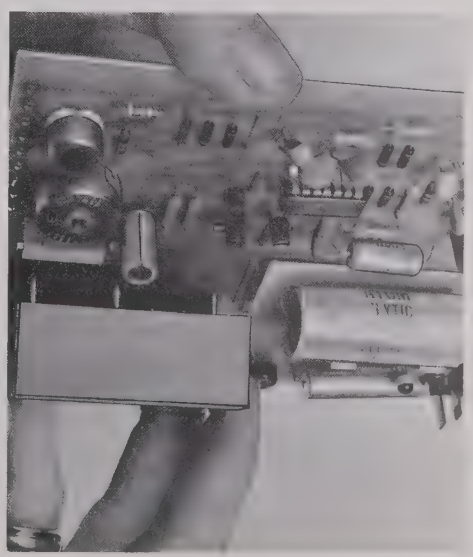
3.3.7.3 REPLACING DC-DC CONVERTER P/C BOARD (Refer to Figure 4-14)

1. Make certain that Analyzer is disconnected from a-c input power.

2. Refer to steps 2 through 6 of paragraph 3.3.7.2 and remove Main Circuit Board from instrument chassis. Taking care not to strain connecting wires, tilt Main Circuit Board backwards so that back of board is readily accessible.

3. Unsolder four connecting points indicated in sketch below, and carefully pull DC-DC Converter Board free from Main Circuit Board.





4. Install new DC-DC Converter Board. Resolder connecting points that were unsoldered in step 3 above.

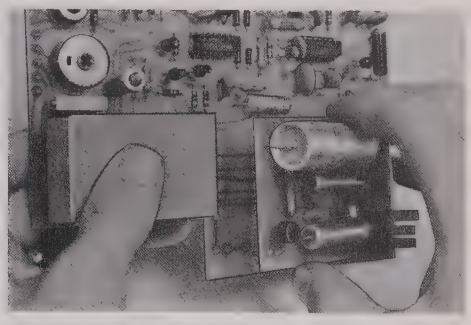
5. Remount Main Circuit Board on chassis. Replace meter assembly on meter mounting bracket and on main circuit board.

6. Reassemble Analyzer in reverse order of disassembly.

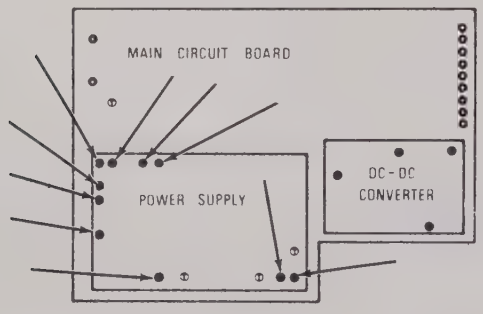
3.3.7.4 REPLACING POWER SUPPLY P/C BOARD (Refer to Figure 4-15)

1. Make certain that Analyzer is disconnected from a-c input source.

2. Refer to steps 2 through 6 of paragraph 3.3.7.2 and remove Main Circuit Board from instrument chassis. Taking care not to strain connecting wires, tilt Main Circuit Board backwards so that back of board is readily accessible.



3. Unsolder ten connecting points indicated in sketch below, and carefully pull Power Supply Board free from Main Circuit Board.



4. Install new Power Supply Board. Resolder connecting points that were unsoldered in step 3 above.

5. Remount Main Circuit Board on chassis. Replace meter assembly on meter mounting bracket and on main circuit board.

6. Recalibrate Analyzer as described in paragraph 3.4.

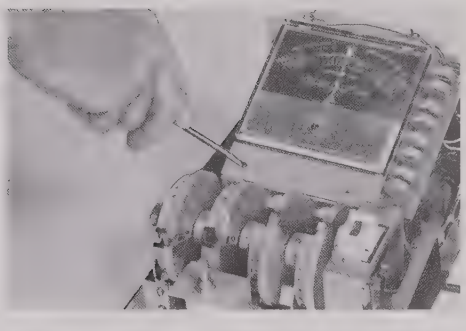
7. Reassemble Analyzer in reverse order of disassembly.

3.3.8 REPLACING METER

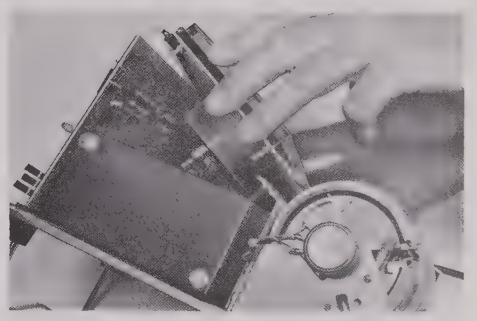
1. Ensure that Analyzer is disconnected from a-c input power.

2. Remove instrument cover from chassis (refer to steps 1, 2, and 3 of paragraph 3.1 if necessary).

3. Loosen and remove two screws securing meter assembly to meter mounting bracket assembly.



4. Carefully lift meter assembly from mounting bracket and Main Circuit Board. Main Circuit Board is held to Meter Assembly by spring clip and will pull free with slight pressure.



CAUTION

When performing step 5 below, note the color of the meter leads before disconnecting. Polarity must be correct when meter leads are reconnected.

5. Loosen and remove nuts securing input leads to meter terminals. Remove input leads from meter terminals.

6. Loosen and remove four nuts securing meter to meter bracket. Meter, meter bracket and Compensating Circuit Board will separate. Set Compensating Circuit Board and meter bracket aside.

7. Install new meter in meter bracket; remount Compensating Circuit Board. Place nuts on four meter-mounting posts and tighten.

8. Connect input leads to meter.

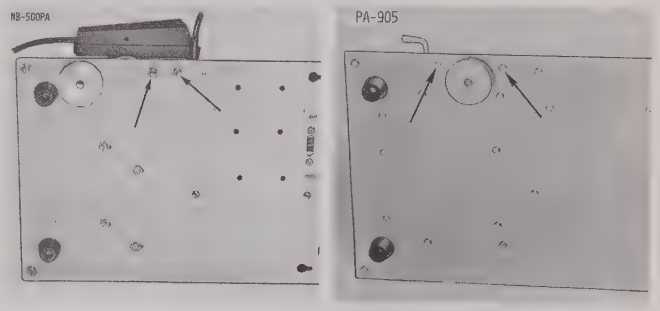
9. Reassemble Analyzer in reverse order of disassembly.

3.3.9 REPLACING ON/OFF SWITCH

1. Ensure that Analyzer is disconnected from a-c input power.

2. Remove instrument cover from chassis (refer to steps 1, 2, and 3 of paragraph 3.1 if necessary). Set chassis on its left side (i.e. side without probe cradle).

3. Loosen and remove two screws securing probe cradle to chassis. Remove probe cradle and set it aside.



4. Carefully note color coding and corresponding terminal for each wire connected to On/Off Switch.

5. Unsolder and disconnect all wires from On/Off Switch.

6. Loosen and remove two screws and nuts securing On/Off Switch to switch bracket. Remove switch from bracket.

7. Install new switch; connect wires disconnected in step 5 above (color coding should correspond with that noted in step 4 above).

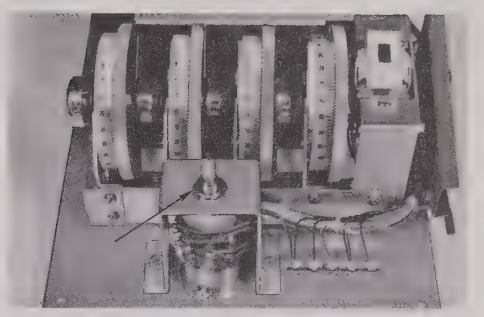
8. Reassemble Analyzer in reverse order of disassembly.

3.3.10 REPLACING SELECTOR SWITCH

1. Ensure that Analyzer is disconnected from a-c input power.

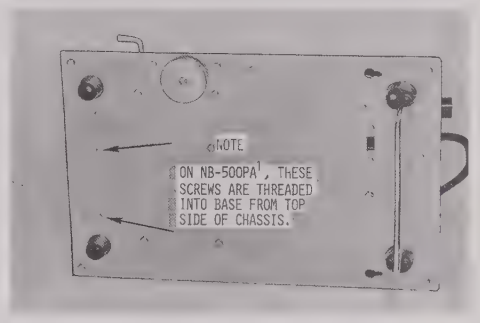
2. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).

3. Using open-end wrench, loosen and remove hex nut (and lockwasher) from shaft of selector switch.

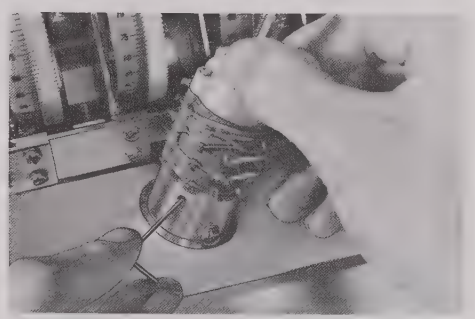


4. Set Analyzer chassis on its side (i.e. side without probe cradle).

5. Loosen and remove two screws securing switch bracket to chassis. Remove switch bracket from chassis and set it aside.



6. Using #6 Allen wrench loosen (do not remove) setscrew securing drive pulley to shaft of selector switch.



7. Carefully note color coding and corresponding terminal for each wire connected to selector switch.

8. Unsolder and remove all wires connected to selector switch.

9. Install new selector switch; connect wires (disconnected in step 8 above) to appropriate terminals. Place knob on shaft of selector switch.

10. Remove photomultiplier tube, lens shield, thermistor subassembly, and imaging optics subassembly from photomultiplier housing (refer to steps 1, 2 and 3 of paragraph 3.3.4). Make certain that filters index properly when Filter Selector Switch is rotated. Remove knob from shaft of Selector Switch.

11. Reassemble Analyzer in reverse order of disassembly.

[1]Super Chromegatron I

3.3.11 REPLACING 115/230 SWITCH

1. Ensure that Analyzer is disconnected from a-c input power.

2. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).

3. Refer to steps 3, 4, 5, and 6 of paragraph 3.3.7.2 and dismount Power Bracket Assembly (PA-905 only), Meter Assembly and Main Circuit Board from chassis. 115/230 switch is now accessible.

CAUTION

When performing step 4 below, carefully note switch-wiring scheme before disconnecting wires; this will help to insure that the new switch is wired properly when installed.

4. Unsolder and remove all wires connected to 115/230 switch.

5. Using nut driver or socket wrench, loosen and remove two nuts and machine screws securing 115/230 switch to chassis. Remove switch.

6. Install new switch. Switch should be positioned so that 115 pole is closest to chopper motor and 230 pole is closest to transformer.

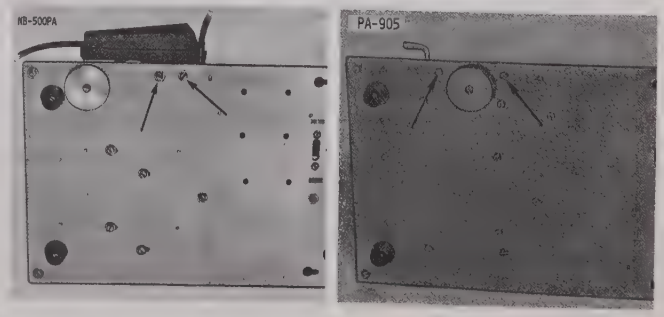
7. Connect wires disconnected in step 4 above.

8. Reassemble Analyzer in reverse order of disassembly.

3.3.12 REPLACING ELECTRONIC f-STOP (Potentiometer R506)

1. Ensure that the Analyzer is disconnected from a-c input power.

2. Remove instrument cover from chassis (refer to steps 1, 2, and 3 of paragraph 3.1 if necessary). Set chassis on its left side (i.e. side without probe cradle).

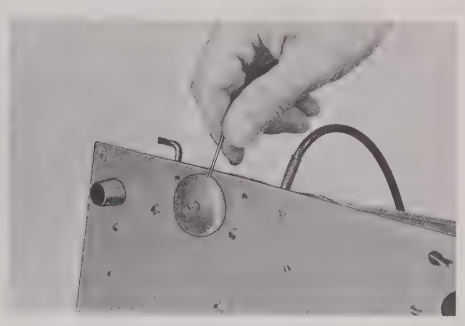


3. Loosen and remove two screws securing probe cradle to chassis. Remove probe cradle and set it aside.

4. Set chassis upright, and carefully note color coding and corresponding terminal for each wire connected to potentiometer R506.

5. Unsolder and disconnect wires from potentiometer R506.

6. Tilt chassis on its side. Using #6 Allen wrench, loosen setscrew securing thumbwheel to shaft of potentiometer. Remove thumbwheel.



7. Using 1/2 inch open-end wrench, loosen and remove hex nut and lockwasher securing potentiometer R506 to chassis. Remove potentiometer R506 from chassis and set it aside.

8. Install new potentiometer and connect wires (disconnected in step 5 above) to appropriate terminals as noted in step 4.

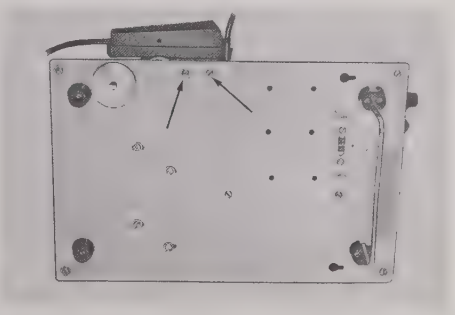
9. Reassemble Analyzer in reverse order of disassembly.

3.3.13 REPLACING, CALIBRATE POTENTIOMETER R501 (NB-500PA ONLY)

1. Ensure that Analyzer is disconnected from a-c input power.

2. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary). Set chassis on its left side (i.e. side without probe cradle).

3. Loosen and remove two screws securing probe cradle to chassis. Remove probe cradle from chassis.



4. Set chassis upright and carefully note color coding and corresponding terminal for each wire connected to potentiometer R501.

5. Unsolder and disconnect wires from potentiometer R501.

6. Using #6 Allen wrench loosen setscrew securing thumbwheel to shaft of potentiometer. Remove thumbwheel.

7. Using 1/2 inch open-end wrench, loosen and remove hex nut and lockwasher securing potentiometer R501 to probe cradle. Remove potentiometer R501 from probe cradle and set it aside.

8. Install new potentiometer and connect wires (disconnected in step 5 above) to appropriate terminals as noted in step 4.

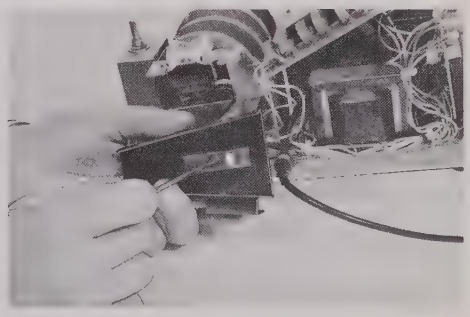
9. Reassemble Analyzer in reverse order of disassembly.

3.3.14 REPLACING CALIBRATION LAMP HOLDER SUBASSEMBLY (NB-500PA[1] ONLY)

1. Ensure that Analyzer is disconnected from a-c input power.

2. Remove probe from probe cradle and remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).

3. Using small screwdriver, loosen and remove two screws securing lamp holder subassembly to probe cradle.



4. Carefully lift lamp holder subassembly (complete with microswitch S504) free of probe cradle.

CAUTION

When performing step 5 below, do not disconnect wires at terminals of lamp holder. Heat from a soldering iron could cause damage to lamp L508. Lamp holder subassemblies are provided complete with input leads.

5. Unsolder and disconnect input leads of lamp holder subassembly from terminal strip on chassis and main circuit board (refer to paragraph 3.3.7.1).

6. Connect input leads of new lamp holder subassembly to terminal strip on chassis and main circuit board.

7. Taking care that actuating lever of microswitch S504 is properly positioned in opening at base of probe cradle, mount new lamp holder subassembly to probe cradle.

8. Reassemble Analyzer in reverse order of disassembly.

[1]Super Chromegatron I

3.3.15 REPLACING ATTENUATORS (Potentiometers R502 through R505), ATTENUATOR DIALS OR ATTENUATOR BRAKE

3.3.15.1 PA-905[2] (Refer to Figure 4-2)

Replacement of an attenuator, an attenuator dial or the attenuator brake, requires special tools that are not commercially available. Therefore, if any of these components becomes defective, it is recommended that the entire attenuator bracket subassembly be replaced and the defective subassembly returned to Macbeth Division of Kollmorgen for repair.

3.3.15.2 NB-500PA[1] (Refer to Figure 4-3)

1. Ensure that Analyzer is disconnected from a-c input power.

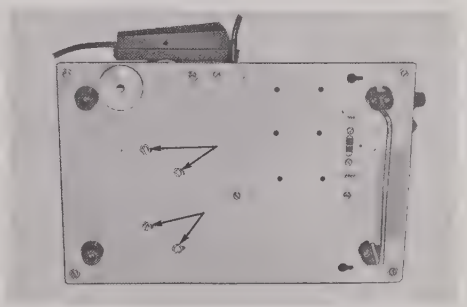
2. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).

3. Set chassis on its left side (i.e. side without probe cradle).

CAUTION

When performing step 4 below, take care not to lose buildup washers located between attenuator bracket and chassis.

4. Loosen and remove two screws securing appropriate attenuator bracket to chassis. Set chassis upright and lift attenuator subassembly from chassis.



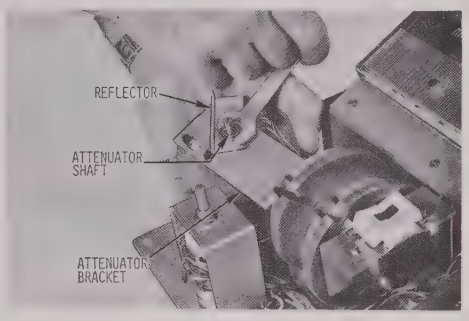
NOTE

In order to replace the attenuator or attenuator dial on the left side of the attenuator subassembly, it is necessary (for accessibility) to first remove the attenuator and attenuator dial on the right side of the subassembly.

[1] Super Chromegatron I
[2] Super Chromegatron II

5. Starting with attenuator dial and attenuator on right side of subassembly, proceed as outlined in steps a through c below until faulty component has been removed from subassembly.

a. Using #6 Allen wrench, loosen setscrew securing attenuator dial to shaft of attenuator. Remove attenuator dial from attenuator shaft.



b. Using 1/2 inch open-end wrench loosen and remove hex nut and lockwasher securing reflector and attenuator to attenuator bracket. Remove attenuator and reflector from bracket. Proceed to step 6 below.

c. If attenuator is to be replaced, note color coding and corresponding terminal for each wire connected to attenuator. Unsolder and disconnect all wires from attenuator.

6. Reassemble attenuator subassembly with new component(s) in place and remount attenuator subassembly to chassis (see note below).

NOTE

#6 flatwasher should be placed between attenuator bracket and chassis.

NOTE

When performing step 7 below, the attenuator subassembly and/or attenuator dials may have to be repositioned slightly for proper alignment with the instrument cover.

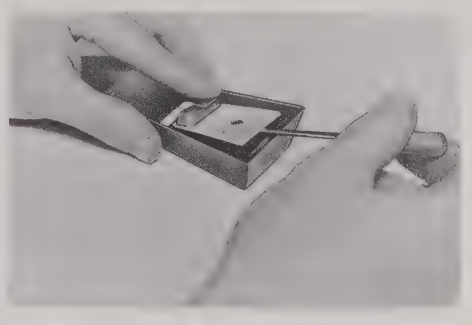
7. Reassemble Analyzer in reverse order of disassembly.

3.3.16 REPLACING TARGET PLATE OF PROBE

1. Adjust Cosine Correction Bar of probe so that target plate is tilted completely to one side.

2. Using small screwdriver, loosen and remove screw securing target plate to one side of fiber-optic barrel.

3. Tilt target plate in opposite direction from that in step 1 and remove screw securing target plate to other side of fiber-optic barrel.

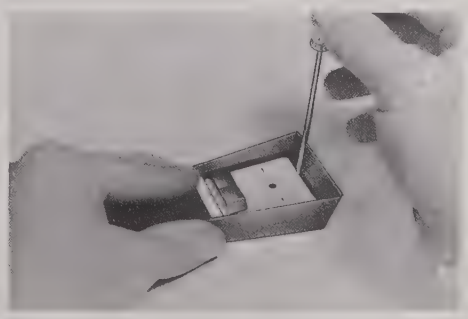


4. Adjust Cosine Correction Bar to level Target Plate. Using small screwdriver, carefully pry Target Plate loose from Fiber Optic Barrel. Remove Target Plate and set it aside.

NOTE

When performing step 5 below, reading spot of Fiber Optic Barrel should be approximately in center of hole in Target Plate.

5. Position new Target Plate on Fiber Optic Barrel and press in place.



6. Using small screwdriver for leverage, carefully move Target Plate forwards or backwards (if required) to align screw hole of Fiber Optic Barrel and Target Plate.

7. Install and tighten screws removed in steps 2 and 3 above.

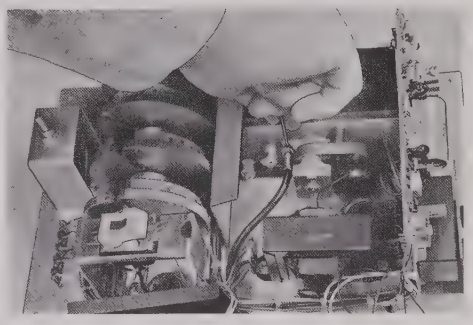
3.3.17 REPLACING FIBER OPTIC CABLE

1. Ensure that Analyzer is disconnected from a-c input power.

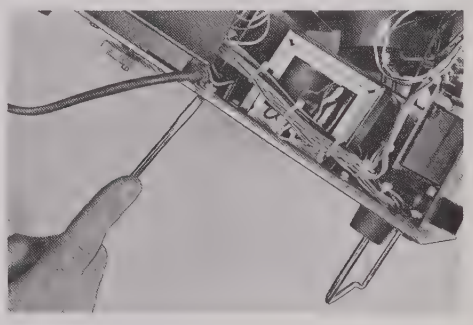
2. Remove instrument cover from chassis (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).

3. Remove meter assembly from meter-mounting bracket (refer to steps 4 and 5 of paragraph 3.3.7.2 if necessary).

4. Using #6 Allen wrench, loosen (do not remove) setscrew securing fiber-optic cable to photomultiplier housing.



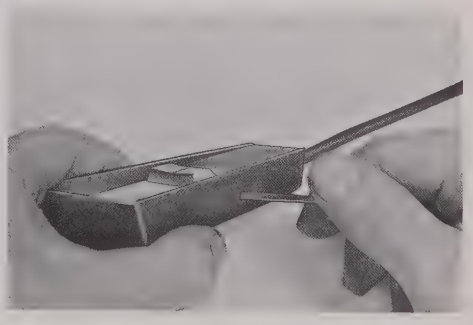
5. Using nut driver or socket wrench, loosen (do not remove) nut securing cable clamps to chassis.



6. Disengage fiber-optic cable from receptacle on photomultiplier housing. Slip cable (complete with protective sleeving) through cable clamp.

7. Remove target plate from probe (refer to steps 1 through 4 of paragraph 3.3.16 if necessary).

8. Using #10 Allen wrench, loosen (do not remove) setscrew securing fiber-optic cable to probe housing.



9. Install new cable in probe and reassemble Analyzer in reverse order of disassembly.

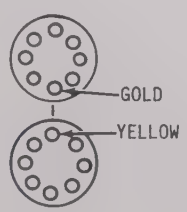
3.4. OVERALL ALIGNMENT/CALIBRATION

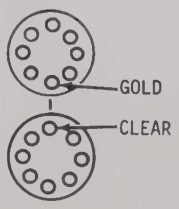
3.4.1 GENERAL

The Analyzer should be calibrated each time a printed circuit board is replaced or a new photomultiplier tube is installed. Additionally, it is advisable to check instrument calibration whenever any of the electric/electronic components or instrument filters are replaced.

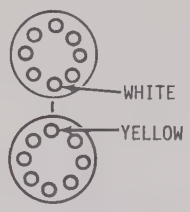
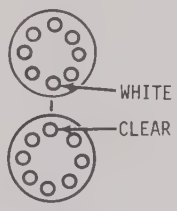
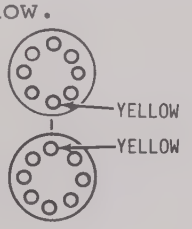
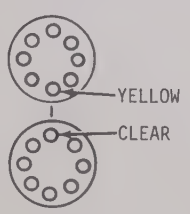
3.4.2 PA-905[2] CALIBRATION

Calibration of the PA-905[2] requires the use of the Color Analyzer Calibration Unit, Model CACU. Proceed as follows:

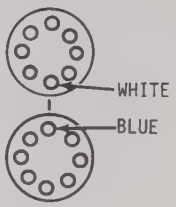
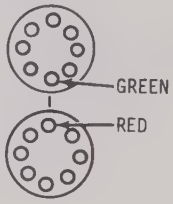
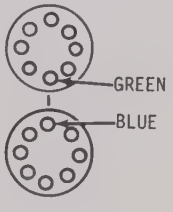
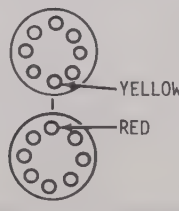
	DO THIS ON CACU	DO THIS ON PA-905[2]
INITIAL SETUP		1. Ensure that a-c input power is disconnected from PA-905 Remove instrument cover (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).
INITIAL SETUP	2. Connect CACU to regulated 120 volt 60 Hz power source. Allow CACU to warm up for ten minutes.	
INITIAL SETUP	3. Set probe of PA-905 in probe holder of CACU. Make certain that probe cable sets in slot at lower left corner of probe compartment. Close compartment door.	
INITIAL SETUP		4. Connect input power to PA-905 turn on PA-905.
METER CENTER		5. Set all attenuators fully past 100.
METER CENTER	6. Set upper filter wheel at gold and lower filter wheel at yellow. 	
METER CENTER		7. Rotate Filter Selector Switch to white (exposure) attenuator.
	[2]Super Chromegatron II	

DO THIS ON CACU	DO THIS ON PA-905[2]
	8. Adjust potentiometer R306 (see figure 4-13) to obtain NULL indication on meter. NOTE To avoid the possibility of electric shock, disconnect a-c input power while performing step 9 below. 9. Connect jumper wire between left side of resistor R411 on Compensating Circuit Board (see Figure 4-16) and center tap of potentiometer R506 (Electronic f-Stop). Probe cradle may have to be removed to provide access (see step 3 of paragraph 3.3.9) NOTE This jumper wire should not be disconnected until Attenuator Range Adjustment is completed (i.e. until step 49 of this procedure). 10. Set all cut and effect potentiometers (R403 through R410) fully clockwise. 11. With Filter Selector Switch set at Exposure Attenuator, adjust Electronic f-Stop to obtain 9-second indication on meter.
12. Set lower filter wheel at clear.  	13. Adjust potentiometer R321 (see figure 4-13) to obtain 50 second indication on meter.

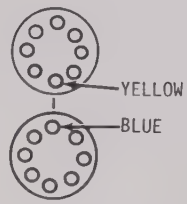
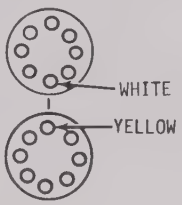
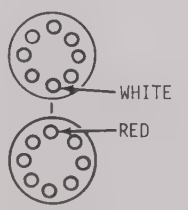
[2] Super Chromegatron II

DO THIS ON CACU	DO THIS ON PA-905[2]
14. Set upper filter wheel at white and lower filter wheel at yellow. 	
	15. Adjust Electronic f-Stop to obtain 9-second indication on meter.
16. Set lower filter wheel at clear. 	
	17. Adjust potentiometer R407 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 14 through 17 and readjust R407 as required.
18. Set upper filter wheel at yellow and lower filter wheel at yellow. 	
	19. Adjust Electronic f-Stop to obtain 9-second indication on meter.
20. Set lower filter wheel at clear. 	
	21. Adjust potentiometer R403 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 18 through 21 and readjust R403 as required.

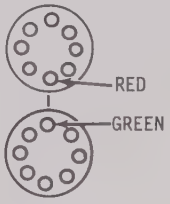
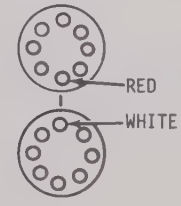
[2] Super Chromegatron II

DO THIS ON CACU	DO THIS ON PA-905[2]
36. Set lower filter wheel at blue.  	
	37. Adjust potentiometer R405 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 34 through 37 and readjust R405 as required.
38. Set upper filter wheel at green and lower filter wheel at red.  	
	39. Adjust Exposure Attenuator to obtain 9-second indication on meter.
40. Set lower filter wheel at blue.  	
	41. Adjust potentiometer R410 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 38 through 41 and readjust R410 as required.
42. Set upper filter wheel at yellow and lower filter wheel at red.  	

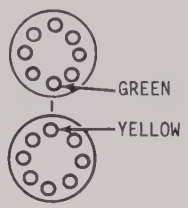
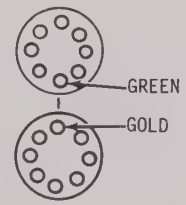
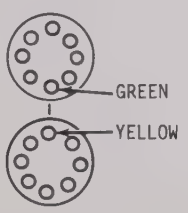
[2] Super Chromegatron II

DO THIS ON CACU	DO THIS ON PA-905[2]
	43. Adjust Exposure Attenuator to obtain 9-second indication on meter.
44. Set lower filter wheel at blue. 	
	45. Adjust potentiometer R406 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 42 through 45 and readjust R406 as required.
46. Set upper filter wheel at white and lower filter wheel at yellow. 	
	47. Rotate Filter Selector Switch to Green (Magenta[2]) Attenuator; set green attenuator fully past 100.
	48. Adjust Electronic f-Stop to obtain 40-second indication on meter.
49. Set lower filter wheel at red. 	
	50. Set Green (Magenta[2]) Attenuator at 0. Adjust potentiometer R362 (see figure 4-13) to obtain NULL indication on meter. NOTE To avoid the possibility

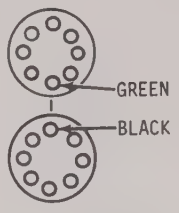
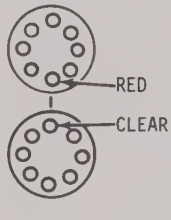
[2]Super Chromegatron II

DO THIS ON CACU	DO THIS ON PA-905[2]
	of electric shock, it is advisable to disconnect a-c input power while performing step 51 below.
	51. Remove jumper wire connected to resistor R411 and potentiometer R506 in step 9 of this procedure.
52. Set upper filter wheel at red and lower filter wheel at green. 	
	53. Rotate Filter Selector Switch to Blue (Yellow[2]) Attenuator position. Adjust Blue Attenuator or Electronic f-Stop to obtain NULL indication on meter.
54. Set lower filter wheel at white. 	
	55. Adjust potentiometer R324 (see figure 4-13) to obtain +.10 ± lcc on meter (see note below).
	NOTE + values appear as SUBTRACT FILTRATION indications on meter.

[2]Super Chromegatron II

DO THIS ON CACU	DO THIS ON PA-905[2]
56. Set upper filter wheel at green and lower filter wheel at yellow.  	
	57. Rotate Filter Selector Switch to Green (Magenta[2]) Attenuator position. Adjust Green Attenuator and/or Electronic f-Stop to obtain NULL indication on meter.
58. Set lower filter wheel at gold.  	
	59. Meter should indicate between +.17 and +.25. Improper meter response is possible indication of: (1) defective photomultiplier tube or; (2) defective green filter.
60. Set lower filter wheel at yellow.  	
	61. Rotate Selector Switch to Red (Cyan[2]) Attenuator. Adjust Red Attenuator and/or Electronic f-Stop to NULL meter.

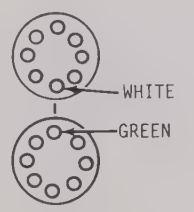
[2] Super Chromegatron II

DO THIS ON CACU	DO THIS ON PA-905[2]
62. Set lower filter wheel at black. 	
	63. Meter should indicate between +.17 and +.25. Improper meter response is a possible indication of: (1) defective photomultiplier tube or; (2) defective red filter.
64. Set upper filter wheel at red and lower filter wheel at clear. 	
	65. Rotate Selector Switch to Exposure (White) Attenuator. Set Exposure Attenuator at 40.
	66. Adjust potentiometer R306 (see figure 4-13) to obtain NULL indication on meter.
67. Remove PA-905 probe from probe holder of CACU. Disconnect CACU from power source.	
	68. Disconnect PA-905 from power source and replace instrument cover.

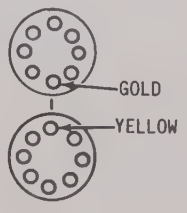
[2]Super Chromegatron II

3.4.3 NB-500PA[1] CALIBRATION

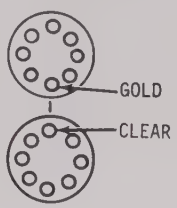
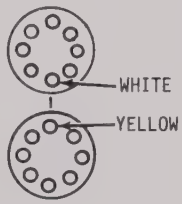
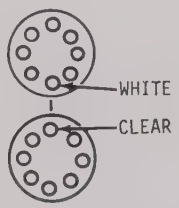
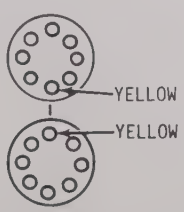
Calibration of the NB-500PA[1] requires the use of Color Analyzer Calibration Unit, Model CACU. Proceed as follows:

	DO THIS ON CACU	DO THIS ON NB-500PA[1]
INITIAL SETUP		1. Ensure that a-c input power is disconnected from NB-500PA. Remove instrument cover (refer to steps 1, 2 and 3 of paragraph 3.1 if necessary).
INITIAL SETUP	2. Connect CACU to regulated 120 volt 60 Hz power source. Allow CACU to warm up for ten minutes.	
INITIAL SETUP	3. Set probe of NB-500PA in probe holder of CACU. Make certain that probe cable sets in slot at lower left corner of probe compartment. Close compartment door.	
INITIAL SETUP		4. Connect input power to NB-500PA; turn on NB-500PA.
METER CENTER	5. Set upper filter wheel at white and lower filter wheel at green. 	
METER CENTER		6. Rotate Filter Selector Switch to Blue Attenuator; set Blue Attenuator at 100.
METER CENTER		7. Set Electronic f-Stop fully counter clockwise. Set Calibrate potentiometer (R501) at approximate mid-range position.
METER CENTER		8. Adjust potentiometer R306 (see figure 4-13) for NULL indication on meter.

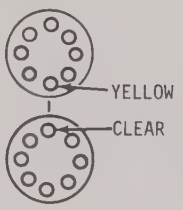
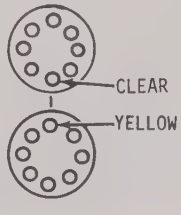
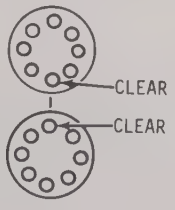
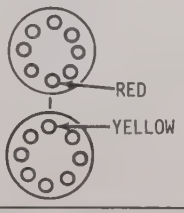
[1]Super Chromegatron I

DO THIS ON CACU	DO THIS ON NB-500PA[1]
	9. Rotate Calibrate potentiometer (R501) completely clockwise and counterclockwise and observe meter deflection. Readjust R306 as required to obtain equal meter deflection on both sides of NULL area.
	NOTE To avoid the possibility of electric shock, disconnect a-c input power while performing step 10 below.
	10. Connect jumper wire between left side of resistor R411 on Compensating Circuit Board (see figure 4-16) and center tap of potentiometer R506 (Electronic f-Stop). Probe cradle may have to be removed to provide access (see step 3 of paragraph 3.3.9)
	NOTE This jumper wire should not be disconnected until attenuator-range adjustment is completed (i.e. until step 53 of this procedure).
	11. Set all cut and effect potentiometers (R403 through R410) fully clockwise.
12. Set upper filter wheel at gold and lower filter wheel at yellow.  	
	13. Rotate Filter Selector Switch to White (Exposure) Attenuator. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.

[1]Super Chromegatron I

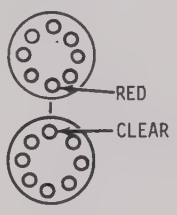
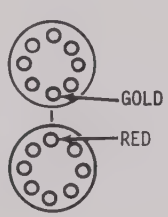
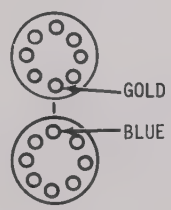
DO THIS ON CACU	DO THIS ON NB-500PA[1]
14. Set lower filter wheel at clear.  	
	15. Adjust potentiometer R321 (see figure 4-13) to obtain 50-second indication on meter.
16. Set upper filter wheel at white and lower filter wheel at yellow.  	
	17. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
18. Set lower filter wheel at clear.  	
	19. Adjust potentiometer R407 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 16 through 19 and readjust R407 as required.
20. Set upper filter wheel at yellow and lower filter wheel at yellow.  	

[1]Super Chromegatron I

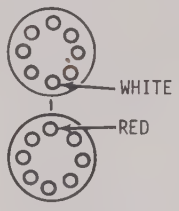
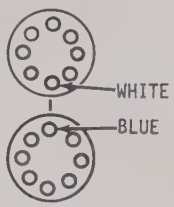
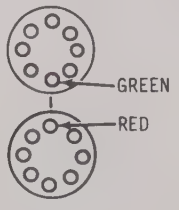
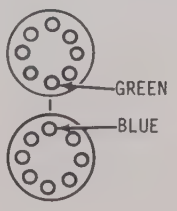
DO THIS ON CACU	DO THIS ON NB-500PA[1]
	21. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
22. Set lower filter wheel at clear. 	
	23. Adjust potentiometer R403 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 20 through 23 and readjust R403 as required.
24. Set upper filter wheel at clear and lower filter wheel at yellow. 	
	25. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
26. Set lower filter wheel at clear. 	
	27. Adjust potentiometer R408 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 24 through 27 and readjust R408 as required.
28. Set upper filter wheel at red and lower filter wheel at yellow. 	

[1] Super Chromegatron I

EXPOSURE, CUT AND EFFECT ADJUSTMENT

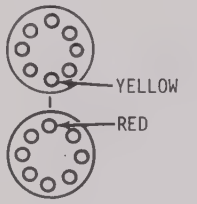
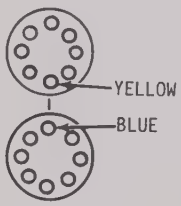
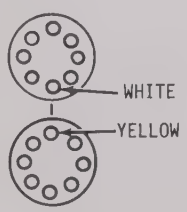
DO THIS ON CACU	DO THIS ON NB-500PA[1]
	29. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
30. Set lower filter wheel at clear. 	31. Adjust potentiometer R404 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 28 through 31 and readjust R404 as required.
32. Set upper filter wheel at gold and lower filter wheel at red. 	33. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
34. Set lower filter wheel at blue. 	35. Adjust potentiometer R409 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 32 through 35 and readjust R409 as required.

[1]Super Chromegatron I

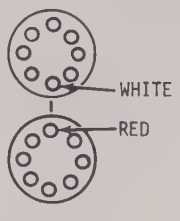
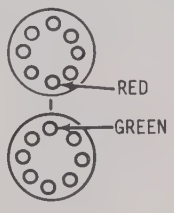
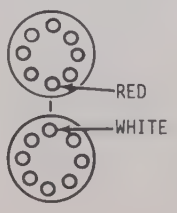
DO THIS ON CACU	DO THIS ON NB-500PA[1]
36. Set upper filter wheel at white and lower filter wheel at red. 	
	37. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
38. Set lower filter wheel at blue. 	
	39. Adjust potentiometer R405 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 36 through 39 and readjust R405 as required.
40. Set upper filter wheel at green and lower filter wheel at red. 	
	41. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
42. Set lower filter wheel at blue. 	

[1] Super Chromegatron I

EXPOSURE, CUT AND EFFECT ADJUSTMENT

DO THIS ON CACU	DO THIS ON NB-500PA[1]
	43. Adjust potentiometer R410 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 40 through 43 and readjust R410 as required.
44. Set upper filter wheel at yellow and lower filter wheel at red. 	45. Adjust Electronic f-Stop or Exposure Attenuator to obtain 9-second indication on meter.
46. Set lower filter wheel at blue. 	47. Adjust potentiometer R406 (see figure 4-16) to obtain 50-second indication on meter. Repeat steps 44 through 47 and readjust R406 as required.
48. Set upper filter wheel at white and lower filter wheel at yellow. 	49. Rotate Filter Selector Switch to Green (Magenta[1]) Attenuator. Set Green Attenuator fully past 100. 50. Adjust Electronic f-Stop to obtain 40-second indication on meter.

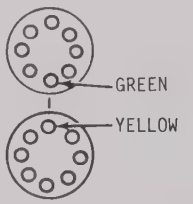
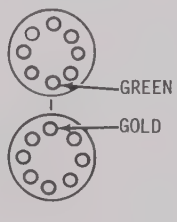
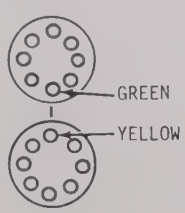
[1]Super Chromegatron I

DO THIS ON CACU	DO THIS ON NB-500PA[1]
51. Set lower filter wheel at red.  	
	52. Set Green (Magenta[1]) Attenuator at 0. Adjust potentiometer R362 (see figure 4-13) to obtain NULL indication on meter. NOTE To avoid the possibility of electric shock, it is advisable to disconnect a-c input power while performing step 53 below.
	53. Remove jumper wire connected to resistor R411 and potentiometer R506 in step 10 of this procedure.
54. Set upper filter wheel at red and lower filter wheel at green.  	
	55. Rotate Selector Switch to Blue (Yellow[1]) Attenuator position. Adjust Blue Attenuator or Electronic f-Stop to obtain NULL indication on meter.
56. Set lower filter wheel at white.  	

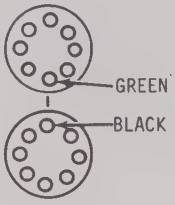
[1]Super Chromegatron I

ATT. RANGE ADJ.

COLOR GAIN ADJUSTMENT

DO THIS ON CACU	DO THIS ON NB-500PA[1]
	57. Adjust potentiometer R324 (see figure 4-13) to obtain +.10 ± 1 cc on meter (see note below). NOTE + values appear as "Subtract Filtration" indications on meter.
58. Set upper filter wheel at green and lower filter wheel at yellow.  	
	59. Rotate Filter Selector Switch to Green (Magenta[1]) Attenuator position. Adjust Green Attenuator to obtain NULL indication on meter.
60. Set lower filter wheel at gold.  	
	61. Meter should indicate between +.15 and +.25. Improper meter response is possible indication of: (1) defective photomultiplier tube or; (2) defective green filter.
62. Set lower filter wheel at yellow.  	

[1]Super Chromegatron I

DO THIS ON CACU	DO THIS ON NB-500PA[1]	
	63. Rotate Filter Selector Switch to Red (Cyan[1]) Attenuator position. Adjust Red Attenuator to NULL meter.	COLOR GAIN ADJUSTMENT
64. Set lower filter wheel at black. 	65. Meter should indicate between +.16 and +.26. Improper meter response is possible indication of: (1) defective photomultiplier tube or; (2) defective red filter.	
	66. Remove probe from probe holder of CACU. Set probe in cradle of NB-500PA.	CAL. LAMP INTENSITY
	67. Rotate Filter Selector Switch to White (Exposure) Attenuator Set Exposure Attenuator at 75.	
	68. Make certain that Calibrate potentiometer (R501) is set at approximate mid-range.	
	69. Adjust potentiometer R326 (see figure 4-13) for NULL indication on meter. Remove probe from cradle.	
	70. Disconnect NB-500PA from a-c input power and replace instrument cover.	
71. Disconnect CACU from a-c input power.		

[1]Super Chromegatron I

SECTION 4

REPLACEMENT PARTS LIST

This section describes the major replaceable parts for the NB-500PA and the PA-905 . For those parts that are peculiar to the NB-500PA or to the PA-905 , appropriate notation is made in the "Usable On" column. If the "Usable On" column does not contain any notation, the part is common to both units.

To expedite delivery when ordering any part, specify the following:

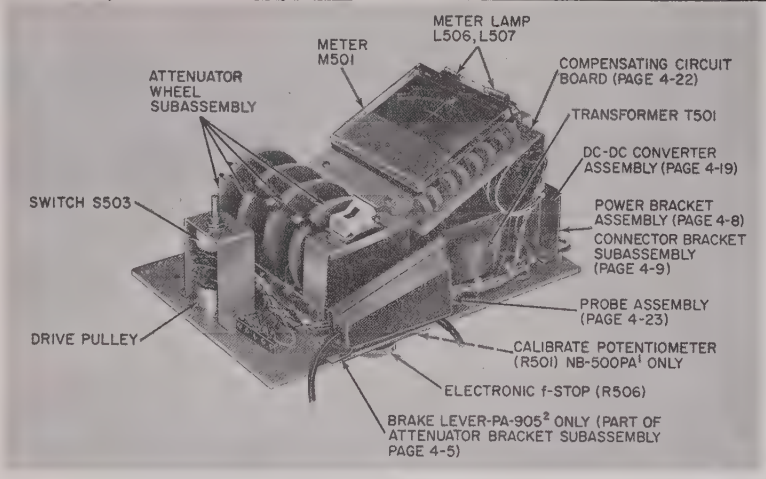
A. Generic name
B. Reference symbol
C. Part number
D. Model and serial number of the equipment containing the part being replaced; this can be obtained from the equipment data plate.

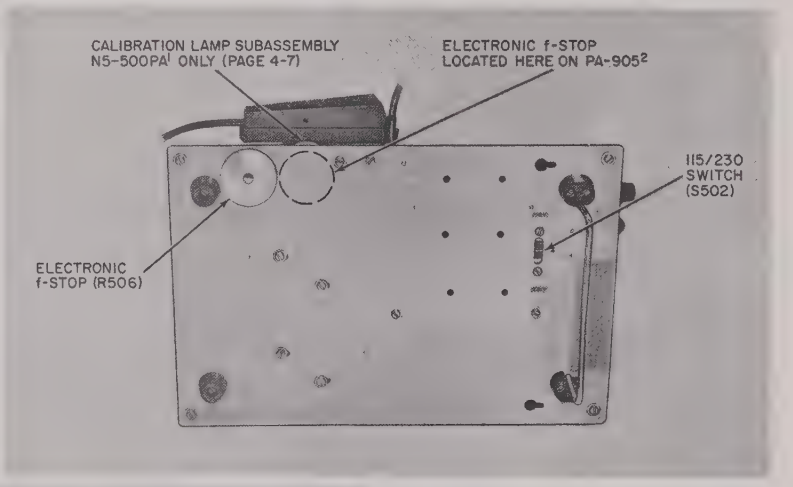
PARTS CATEGORY	PAGE
. Chassis Assembly (Symbol Series 500)	4-2
.. Attenuator Bracket Subassembly (Symbol Series 500)	4-5
.. Attenuator Subassembly (Symbol Series 500)	4-6
.. Calibration Lamp Subassembly (Symbol Series 500)	4-7
.. Power Bracket Assembly (Symbol Series 500)	4-8
.. Connector Bracket Subassembly (Symbol Series 500)	4-9
.. On/Off Switch Subassembly (Symbol Series 500)	4-10
. Photomultiplier Housing Assembly (Symbol Series 500)	4-11
.. Thermistor Subassembly (Symbol Series 500)	4-12
.. Imaging Optics Subassembly (Symbol Series 500)	4-13
.. Photomultiplier Tube Socket Subassembly (Symbol Series 500)	4-13
.. Filter Wheel Subassembly	4-14
. Main Circuit Board (Symbol Series 300)	4-15
. DC-DC Converter (Symbol Series 100)	4-19
. Power Supply (Symbol Series 200)	4-20
. Compensating Circuit Board (Symbol Series 400)	4-22
. Probe Assembly	4-23

[1] Super Chromegatron I
[2] Super Chromegatron II

CHASSIS ASSEMBLY #10004501 (PA-905[2]),
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE


METER LAMP L506, L507
METER M501
ATTENUATOR WHEEL SUBASSEMBLY
COMPENSATING CIRCUIT BOARD (PAGE 4-22)
TRANSFORMER T501
DC-DC CONVERTER ASSEMBLY (PAGE 4-19)
SWITCH S503
POWER BRACKET ASSEMBLY (PAGE 4-8)
CONNECTOR BRACKET SUBASSEMBLY (PAGE 4-9)
PROBE ASSEMBLY (PAGE 4-23)
DRIVE PULLEY
CALIBRATE POTENTIOMETER (R501) NB-500PA[1] ONLY
ELECTRONIC f-STOP (R506)
BRAKE LEVER-PA-905[2] ONLY (PART OF ATTENUATOR BRACKET SUBASSEMBLY PAGE 4-5)


CALIBRATION LAMP SUBASSEMBLY N5-500PA[1] ONLY (PAGE 4-7)
ELECTRONIC f-STOP LOCATED HERE ON PA-905[2]
115/230 SWITCH (S502)
ELECTRONIC f-STOP (R506)

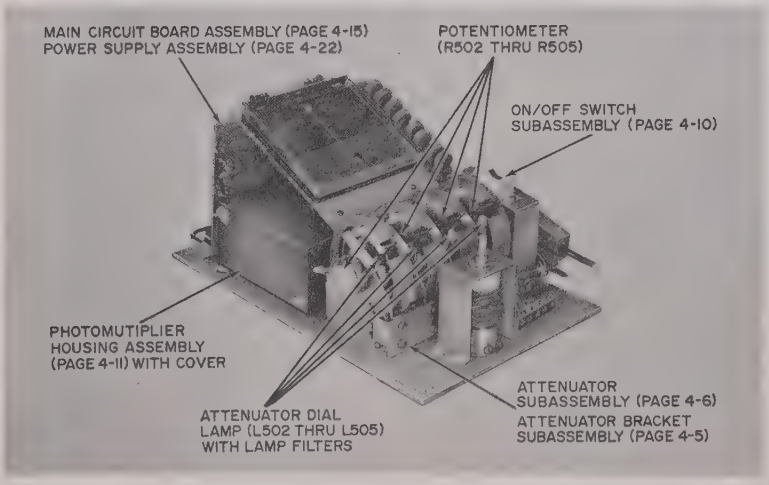

MAIN CIRCUIT BOARD ASSEMBLY (PAGE 4-15)
POWER SUPPLY ASSEMBLY (PAGE 4-22)
POTENTIOMETER (R502 THRU R505)
ON/OFF SWITCH SUBASSEMBLY (PAGE 4-10)
PHOTOMUTIPLIER HOUSING ASSEMBLY (PAGE 4-11) WITH COVER
ATTENUATOR SUBASSEMBLY (PAGE 4-6)
ATTENUATOR BRACKET SUBASSEMBLY (PAGE 4-5)
ATTENUATOR DIAL LAMP (L502 THRU L505) WITH LAMP FILTERS

Figure 4-1 Assembly/Subassembly and Major Components Location, Overall View

[1] Super Chromegatron I
[2] Super Chromegatron II

CHASSIS ASSEMBLY #10004501 (PA-905[2])
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
B501	Part of	Photomultiplier Housing Assembly (see page 4-11)	
F501	Part of	Power Bracket Assembly (PA-905) or Connector Bracket Assembly (NB-500PA) (see page 4-5 or 4-6)	
L502 thru L505	20014001	. LAMP: 14V, .080 amps	
L506, L507		Same as L502	
M501	24001100	. METER: DC, 100-0-100 microammeter	
R501	Part of	Calibration Lamp Subassembly (see page 4-7)	
R502 thru R505	36133000	. POTENTIOMETER: 13K ohms, ±10%, 2 watt, with mounting hardware	
		or	
		. POTENTIOMETER: 13K ohms, 2 watt, with mounting hardware	
R506	36133001	. POTENTIOMETER: 13K ohms, ±10%, 2 watt, with mounting hardware	
R507	Part of	Calibration Lamp Subassembly (see page 4-7)	
R508	Part of	ON/OFF Switch Subassembly (see page 4-10)	
R509 thru R517	Part of	Photomultiplier Housing Assembly (see page 4-11)	
R518	Part of	Thermistor Subassembly (see page 4-12)	
S501	Part of	ON/OFF Switch Subassembly (see page 4-10)	
S502	43020203	. SWITCH	
S503	43080400	. SWITCH: Rotary	
T501	44000240	. TRANSFORMER: Power	
	21007850	. PULLEY, DRIVE:	NB-500PA
	21010380	. PULLEY, DRIVE:	PA-905

[1]Super Chromegatron I
[2]Super Chromegatron II

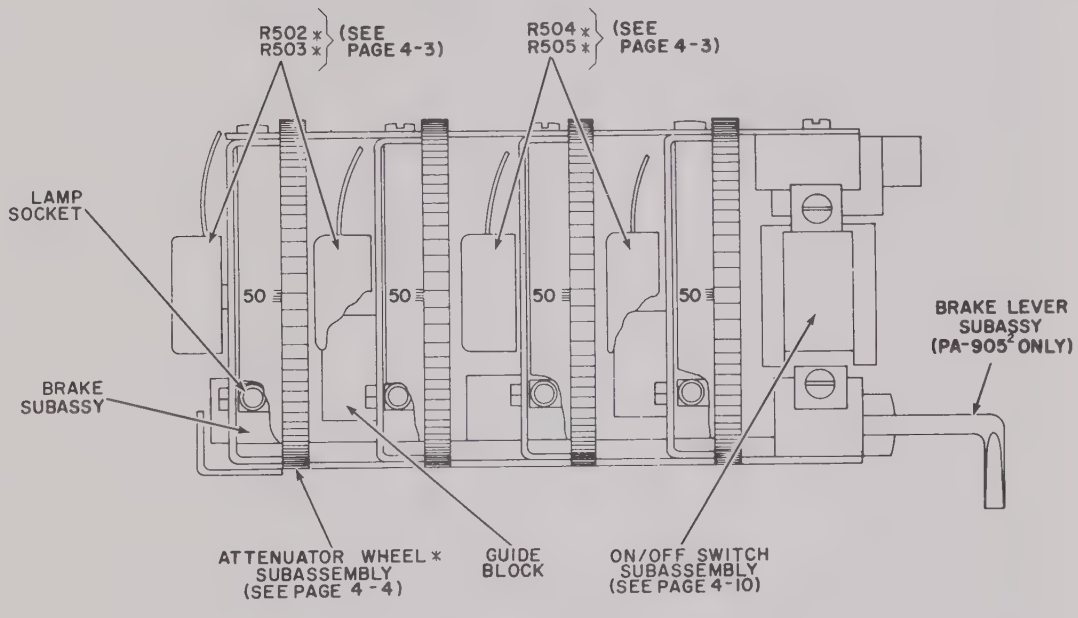
CHASSIS ASSEMBLY #10004501 (PA-905[2])
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

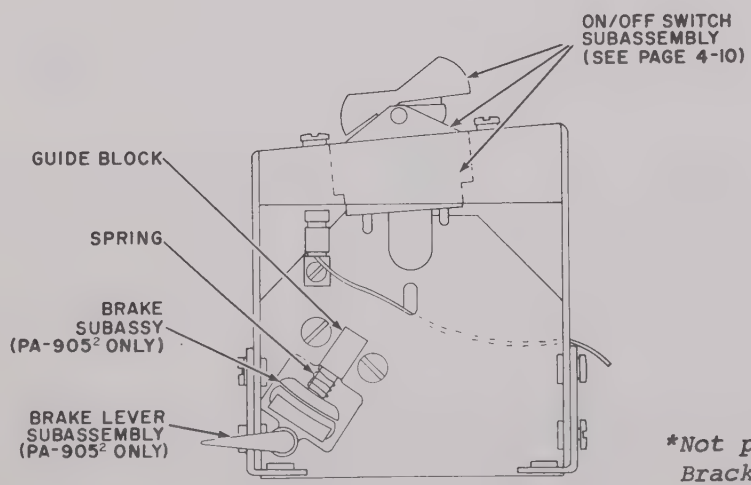
REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
	23005520	. CABLE, DRIVE: BWR 26.1 with BWR 40 fitting each end, loops to fit 1/16 dowel. Length 17-1/2, ±1/32 inches.	PA-905
	23001960	. CABLE, DRIVE: BWR 26.1 with BWR 40 fitting each end, loops to fit 1/16 dowel. Length 16-15/16, ±1/32 inches.	NB-500PA
	50000600	. SPRING: Drive Cable	
	51000320	. PULLEY	PA-905
	21010360	. PULLEY SUPPORT	PA-905
	51000330	. IDLER	PA-905
	21010370	. IDLER SUPPORT	PA-905
	21007810	. IDLER	NB-500PA
	21007820	. IDLER SUPPORT	NB-500PA
	21007610	. PULLEY	
	38004810	. REFLECTOR	PA-905
	38003500	. REFLECTOR	NB-500PA
	55000009	. FILTER, LAMP: Silikrome, Red	
	55000010	. FILTER, LAMP: Silikrome, Green	
	55000011	. FILTER, LAMP: Silikrome, Blue	
	55000012	. FILTER, LAMP: Silikrome, White	
	23001910	. ATTENUATOR WHEEL SUBASSEMBLY	

[1] Super Chromegatron I
[2] Super Chromegatron II

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE

. ATTENUATOR BRACKET SUBASSEMBLY
Part #23005330 (PA-905)





Not part of Attenuator Bracket Subassembly (shown only for purpose of orientation).

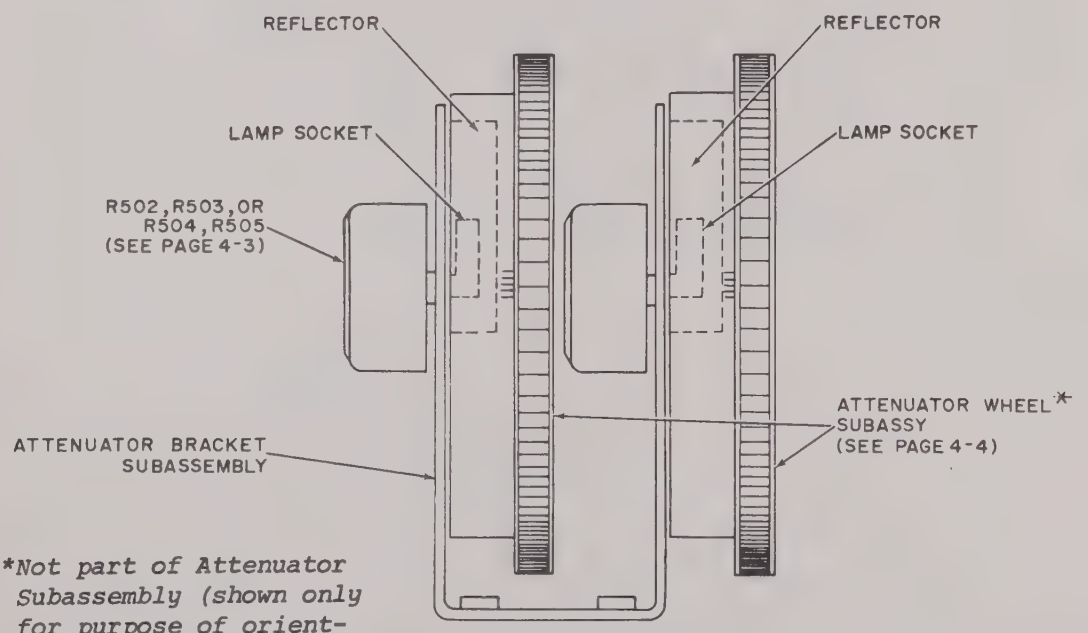
Figure 4-2 Attenuator Bracket Subassembly (PA-905)

[1] Super Chromegatron I
[2] Super Chromegatron II

CHASSIS ASSEMBLY #10004501 (PA-905[2])
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. ATTENUATOR BRACKET SUBASSEMBLY	
	23005360	.. BRAKE LEVER SUBASSEMBLY	PA-905
	23005340	.. BRAKE SUBASSEMBLY	PA-905
	50000680	.. SPRING (music wire)	PA-905
	21010180	.. GUIDE BLOCK	PA-905
	40010002	.. SOCKET, LAMP: Midget grooved	

. ATTENUATOR SUBASSEMBLY
Part #29000880 (NB-500PA)



*Not part of Attenuator Subassembly (shown only for purpose of orientation).

Figure 4-3. Attenuator Subassembly (NB-500PA)

	23001940	.. ATTENUATOR BRACKET SUBASSEMBLY	NB-500PA
	38003500	.. REFLECTOR	
	40010002	.. SOCKET, LAMP: Midget grooved,	

[1]Super Chromegatron I
[2]Super Chromegatron II

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. CALIBRATION LAMP SUBASSEMBLY Part #29000781 (NB-500PA)	

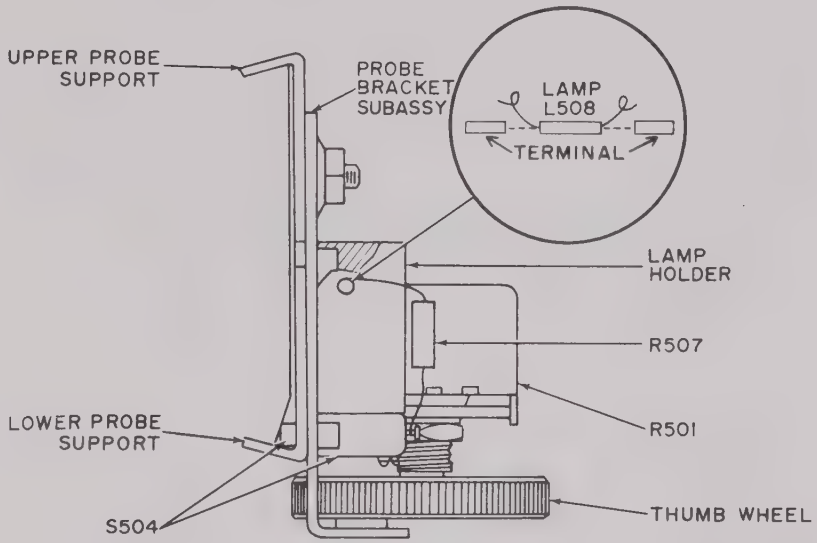


Figure 4-4. Calibration Lamp Subassembly (NB-500PA)

L508		Part of Lamp Holder Subassembly (see below)	
R501	36252006	.. POTENTIOMETER: 2.5K ohms, 2 watt with mounting hardware	NB-500PA
R507, S504		Part of Lamp Holder Subassembly (see below)	
	10002550	.. LAMP HOLDER SUBASSEMBLY	NB-500PA
	20003003	... LAMP (2508): 2.5V, 0.04 amp, (not replaceable as separate item)	
	36101004	... RESISTOR (R507): 100 ohms, ±1%, 1/4 watt, RN60D	NB-500PA
	43010207	... MICROSWITCH (S504):	NB-500PA

[1]Super Chromegatron I
[2]Super Chromegatron II

CHASSIS ASSEMBLY #10004501 (PA-905[2])
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
	21007960	.. THUMBWHEEL	
	23001620	.. PROBE BRACKET SUBASSEMBLY	
	38002350	.. LOWER PROBE SUPPORT	
	38002360	.. UPPER PROBE SUPPORT	

. POWER BRACKET ASSEMBLY
Part #1000448 (PA-905)

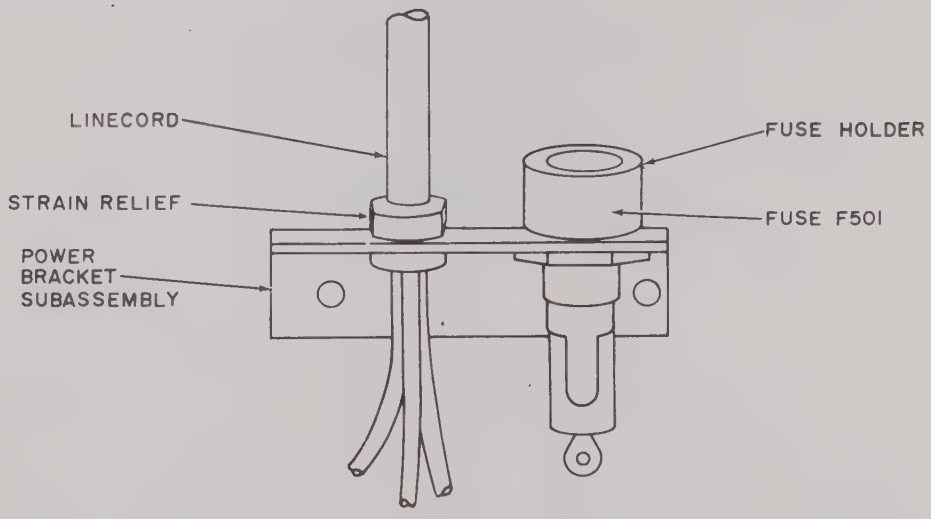


Figure 4-5. Power Bracket Assembly (PA-905)

F501	31002000	.. FUSE: 0.25 amp, 250V, Slo-Blo, #3AG	
	40020045	.. FUSEHOLDER:	PA-905
	12000250	.. STRAIN RELIEF:	PA-905
	05818302	.. LINECORD: 18/3-41/34, 7 ft. to 9 ft., SV Black, with 3-prong plug.	
	23005540	.. POWER BRACKET SUBASSEMBLY	PA-905

[1]Super Chromegatron I
[2]Super Chromegatron II

CHASSIS ASSEMBLY #10004501 (PA-905[2])
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. CONNECTOR BRACKET SUBASSEMBLY Part #10002380 (NB-500PA)	

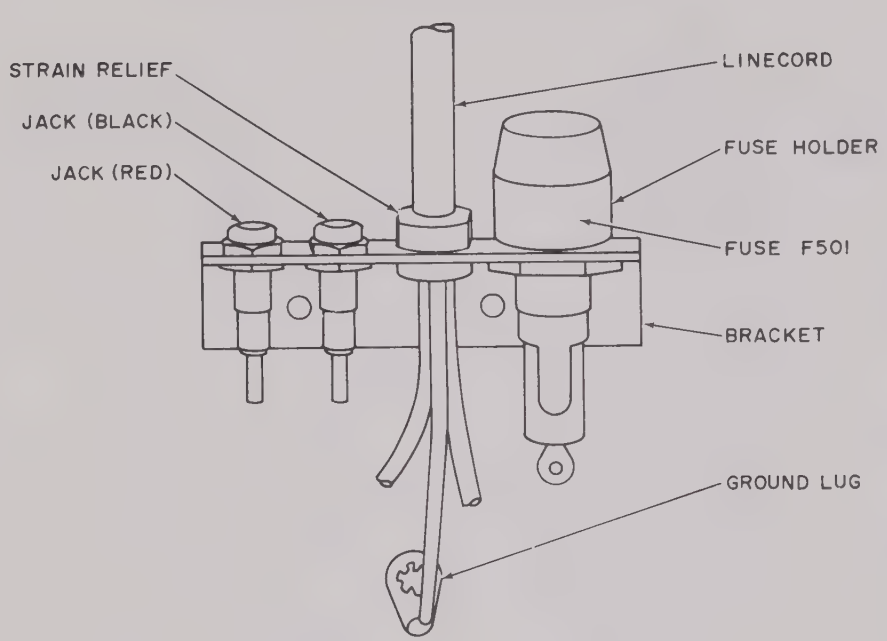


Figure 4-6. Connector Bracket Subassembly (NB-500PA)

F501	31002000	.. FUSE: 0.25 amp, 250V, Slo-Blo, #3AG	
	40020001	.. FUSEHOLDER: #341001-3AG, with mounting hardware	NB-500PA
	05818302	.. LINECORD: 18/3-41/34, 7 ft. to 9 ft., SV Black, with 3-prong plug.	
	12000250	.. STRAIN RELIEF:	NB-500PA
	09010001	.. JACK: Black, mounting nut.	NB-500PA
	09010002	.. JACK: Red, with mounting nut.	NB-500PA
	38003410	.. BRACKET	NB-500PA
	47070002	.. LUG, GROUND	NB-500PA

[1]Super Chromegatron I
[2]Super Chromegatron II

CHASSIS ASSEMBLY #10004501 (PA-905[2])
CHASSIS ASSEMBLY #29000911 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. ON/OFF SWITCH SUBASSEMBLY Part #10001290	

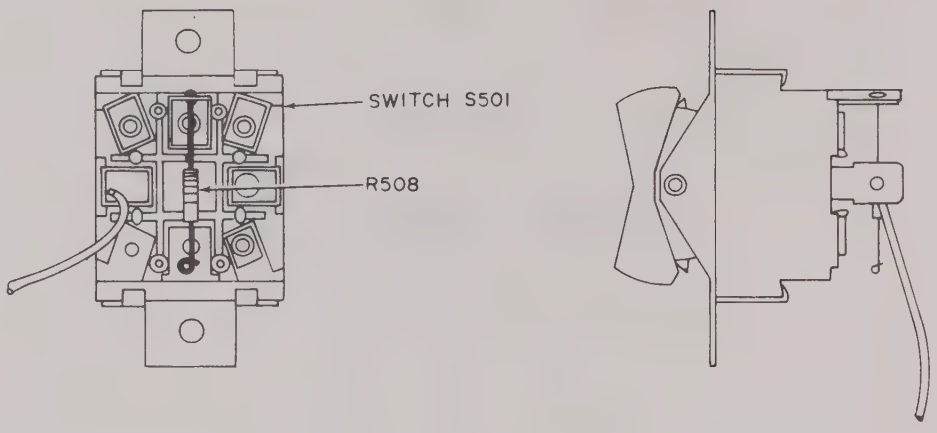


Figure 4-7. ON/OFF Switch Subassembly

R508	36105001	.. RESISTOR, FIXED: 1 Meg ohm, 1/4 watt, ±10%	
S501	43020202	.. SWITCH: Rocker, progressive, lighted	

[1]Super Chromegatron I
[2]Super Chromegatron II

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE

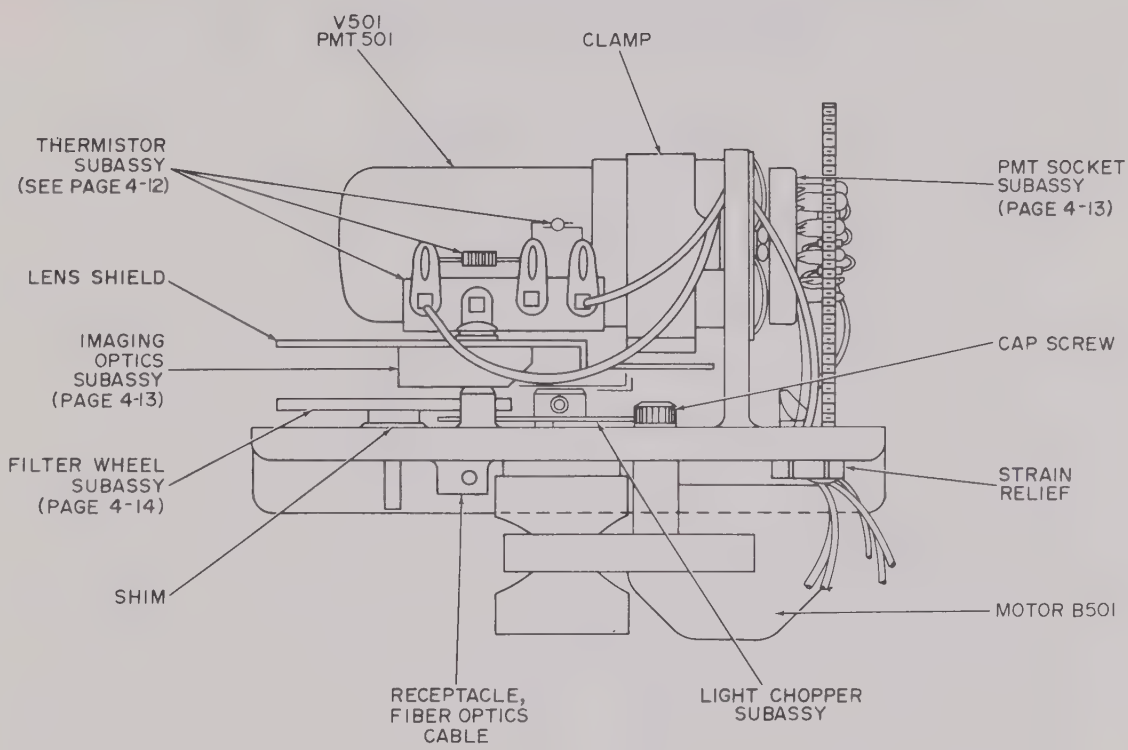


Figure 4-8. Photomultiplier Housing Assembly

B501	25000000	. MOTOR:	
	12000620	. STRAIN RELIEF	
	37110802	. CAP SCREW: Motor Mount, Hex Head, w/Nylok insert	
V501 PMT501	10000709	. PHOTOMULTIPLIER TUBE SUBASSEMBLY	
	38001500	. CLAMP	
	38002510	. LENS SHIELD	
	51200900	. SHIM	
	23001470	. LIGHT CHOPPER SUBASSEMBLY	

PHOTOMULTIPLIER HOUSING ASSEMBLY #29000770

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. THERMISTOR SUBASSEMBLY Part #10004470 (PA-905[2]) Part #10000590 (NB-500PA[1])	

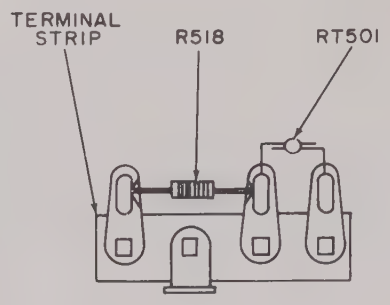


Figure 4-9. Thermistor Subassembly

R518	36334004	.. RESISTOR, FIXED: 330 ohms, ±5%, 1/4 watt	PA-905
	36475001	.. RESISTOR, FIXED: 4.7 Meg ohms, ±5%, 1/2 watt	NB-500PA
RT501	41300002	.. THERMISTOR: 250 K ohms, 10%; hermetecally sealed.	PA-905
	41300000	.. THERMISTOR:	NB-500PA
	09030008	.. TERMINAL STRIP: Lug	PA-905
	09030005	.. TERMINAL STRIP: Lug Type	NB-500PA

[1]Super Chromegatron I
[2]Super Chromegatron II

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. IMAGING OPTICS SUBASSEMBLY Part #29000841 (PA-905[2]) Part #29000840 (NB-500PA[1])	

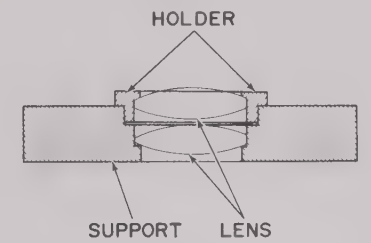
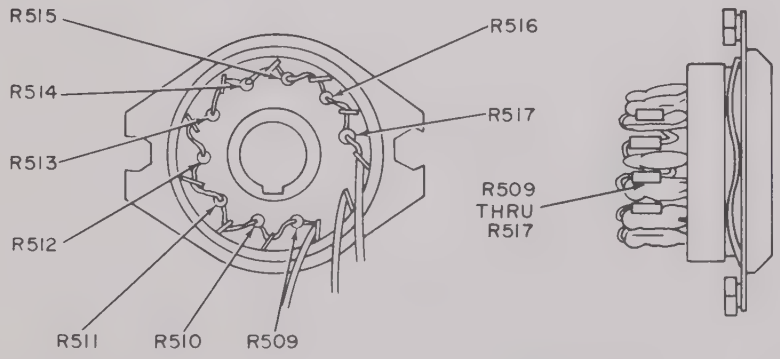


Figure 4-10. Imaging Optics Subassembly

	27000710	.. LENS	
	21004210	.. LENS HOLDER	
	21004221	.. LENS SUPPORT	PA-905
	21004220	.. LENS SUPPORT	NB-500PA

. PHOTOMULTIPLIER TUBE SOCKET SUBASSY.
Part #10002770



IMPORTANT

Specify Model No. of equipment in which replacement part is to be used.

Figure 4-11. Photomultiplier Tube Socket Subassembly

	21404200	.. SOCKET: 11-pin	
R507 thru R517	36224004	.. RESISTOR, FIXED: 220 K ohms, ±1%, RN55D	PA-905
	36224002	.. RESISTOR, FIXED: 220 K ohms, ±1%, 1/10 watt, TC=+200 ppm	NB-500PA

[1]Super Chromegatron I
[2]Super Chromegatron II

PHOTOMULTIPLIER HOUSING ASSEMBLY #29000770

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		. FILTER WHEEL SUBASSEMBLY Part #29001030	
	23001510	.. FILTER WHEEL & SHAFT SUBASSEMBLY	
	55009903	.. FILTER: Green, Wratten #99, 0.562 dia.	
	55004752	.. FILTER: Blue, Wratten #47B, 0.562 dia.	
	55009201	.. FILTER: Red, Wratten #92, 0.562 dia.	
		.. FILTER: Wratten #96 neutral density, 0.562 dia. various densities as required	NB-500PA
	56010001	0.10 density	
	56020001	0.20 density	
	56030001	0.30 density	
	56040001	0.40 density	
	56050001	0.50 density	
	56060001	0.60 density	
	56070001	0.70 density	
	56080001	0.80 density	
	56090001	0.90 density	
	56100001	1.0 density	
		.. FILTER: Wratten #96 neutral density, 0.562 dia.	PA-905
	56030001	0.30 density (used with red filter)	
	56060001	0.60 density (used with green filter)	
	56200001	2.00 density (visual filter)	
	49000000	.. RETAINING RING: Filter, 0.593 dia. Plain ends	

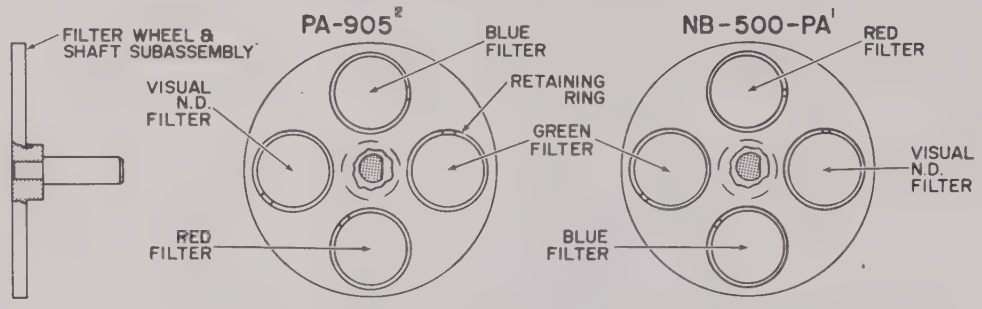


Figure 4-12. Filter Wheel Subassembly

IMPORTANT

Specify Model No. of equipment in which replacement part is to be used.

[1]Super Chromegatron I
[2]Super Chromegatron II

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE

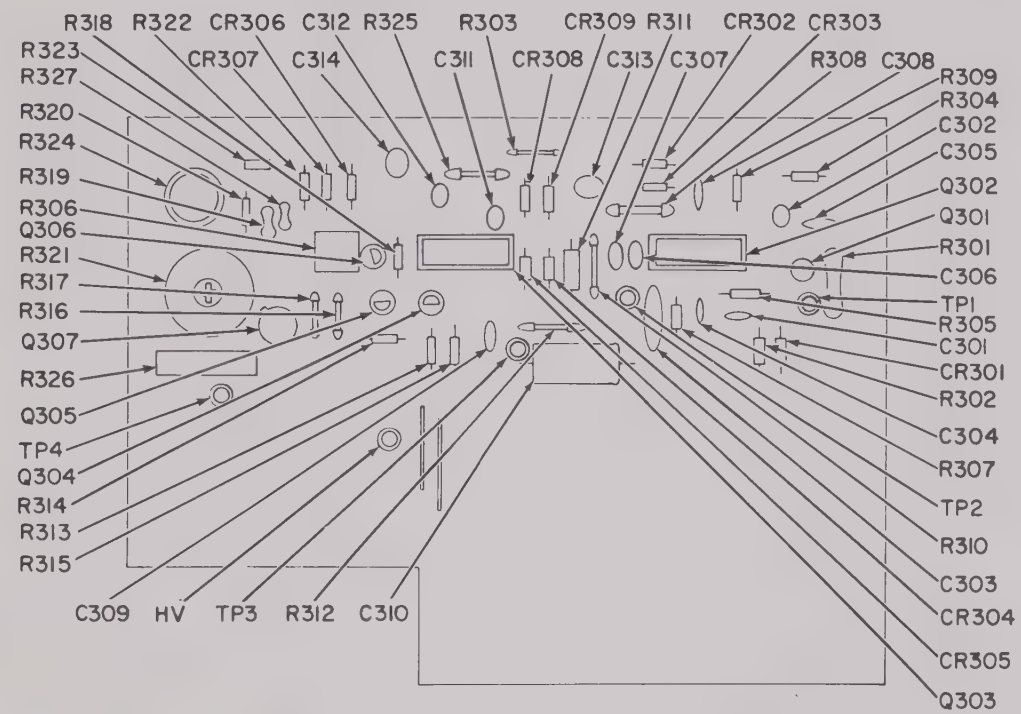


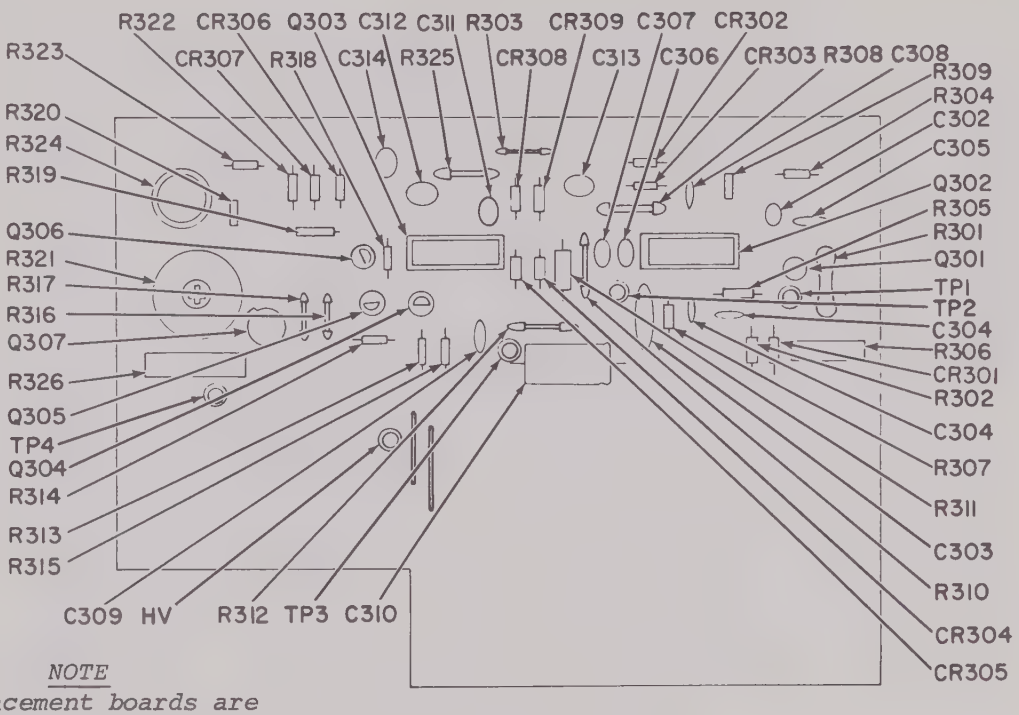
Figure 4-13A. Main Circuit Board, PA-905[2]

C301	06100802	. CAPACITOR: 0.1 mfd, 10 volts, Type Hypercon	
C302	06150600	. CAPACITOR: 15 mfd, 10 volts, Tantalum Series 196D	
C303	06681000	. CAPACITOR: .0068 mfd, 1000 volts, Type HYK	
C304	06470900	. CAPACITOR: .047 mfd, 10 volts, Type Hypercon	

[2]Super Chromegatron II

MAIN CIRCUIT BOARD #10002470

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE



NOTE

Replacement boards are no longer avialable. Defective boards should be returned to Macbeth for repair.

Figure 4-13B. Main Circuit Board, NB-500PA[1]

C305, C306		Same as C301	
C307		Same as C302	
C308, C309		Same as C304	
C310	06100500	. CAPACITOR: 100 mfd, 3 volts	
C311	06680500	. CAPACITOR: 6.8 mfd, 38V, Tantalum	
C312		Same as C304	
C313, C314	06330600	. CAPACITOR: 33 mfd, 4 volts, Tantalum	

[1]Super Chromegatron I

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
CR301	41100027	. DIODE: 1N461A (black)	
CR302 thru CR309	41100016	. DIODE: 1N461A	NB-500PA
	41100027	. DIODE: 1N461A (black)	PA-905
R301	36106000	. RESISTOR, FIXED: 10 meg ohm, ±1%, 1/2 watt, T.C. ±250 ppm	
R302	36124001	. RESISTOR, FIXED: 120K ohms, ±10%, 1/4 watt,	
R303	36222002	. RESISTOR, FIXED: 2.2 K ohms, ±1%, T.C. ±250 ppm	
R304	36331002	. RESISTOR, FIXED: 330 ohm, ±10%, 1/4 watt	NB-500PA
	36252008	. RESISTOR, FIXED: 2.55 K ohm, ±1%, RN55D	PA-905
R305		Same as R302	
R306	36104007	. RESISTOR, VARIABLE: 100 K ohm, .75 watt, ±10%	NB-500PA
	36502002	. RESISTOR, VARIABLE: 5 K ohm, 1 watt, ±20%	PA-905
R307	36222003	. RESISTOR, FIXED: 2.2 K ohm, ±10% 1/4 watt	NB-500PA
	36393002	. RESISTOR, FIXED: 39.2 K ohm, ±1%, RN55D	PA-905
R308	36103007	. RESISTOR, FIXED: 10 K ohms, ±1% 1/4 watt, T.C. ±250 ppm	
R309, R310	36103006	. RESISTOR, FIXED: 10 K ohms, ±10% 1/4 watt	
R311	36502001	. RESISTOR, FIXED: 5 K ohms, ±1%, 1/4 watt, T.C. ±250 ppm	
R312		Same as R308	
R313	36102003	. RESISTOR, FIXED: 1 K ohm, 1/4 watt ±10%	

MAIN CIRCUIT BOARD #10002470

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
R314		Same as R309	
R315		Same as R313	
R316	36102004	. RESISTOR, FIXED: 1 K ohms, ±1%, 1/4 watt, T.C. ±250 ppm	
R317	36262001	. RESISTOR, FIXED: 2.67 K ohm, ±1%, 1/4 watt, T.C. ±250 ppm	
R318	36333001	. RESISTOR, FIXED: 33 K ohm, ±10% 1/4 watt	
R319	36273001	. RESISTOR, FIXED: 27.4 K ohm, ±1%, 1/4 watt, RN60D	NB-500PA
	36393002	. RESISTOR, FIXED: 39.2 K ohm, ±1%, RN55D	PA-905
R320		Same as R309	
R321	36103008	. RESISTOR, VARIABLE: 10 K ohm, ±20%, 2 watts	
R322	36512000	. RESISTOR, FIXED: 5.1 K ohm, ±5%, 1/4 watt	
R323	36473002	. RESISTOR, FIXED: 47 K ohms, ±10% 1/4 watt	NB-500PA
	36333001	. RESISTOR, FIXED: 33 K ohms, ±10%, 1/4 watt	PA-905
R324	36503002	. RESISTOR, VARIABLE: 50 K ohm, ±20%, 3/8 watt	NB-500PA
	36254007	. RESISTOR, VARIABLE: 250 K ohm, ±20%, 3/8 watt	PA-905
R325	36332000	. RESISTOR, FIXED: 3.3 K ohms, ±1% 1/4 watt, T.C. ±250 ppm	
R326	36101003	. RESISTOR, VARIABLE: 100 ohms, ±10%, 1 watt	NB-500PA
	36502003	. RESISTOR, VARIABLE: 5 K ohms	PA-905
Q301	41200004	. TRANSISTOR, JUNCTION: Field Effect	

MAIN CIRCUIT BOARD #10002470

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
Q302,	41200007	. INTEGRATED CIRCUIT	
Q304 Q305 Q306	41200002	. TRANSISTOR Silicon NPN 2N3392	NB-500PA
Q307	41200008	. TRANSISTOR: Silicon	NB-500PA
	41200063	. TRANSISTOR, POWER: 2N3053	PA-905

DC-DC CONVERTER #10002240

NOTES

1. *The DC-DC Converter Board is housed in a steel case which is edge-soldered to a strip on the DC-DC Converter Board.*

2. *HV is a test point designation that is not labeled on the DC-DC Converter Board.*

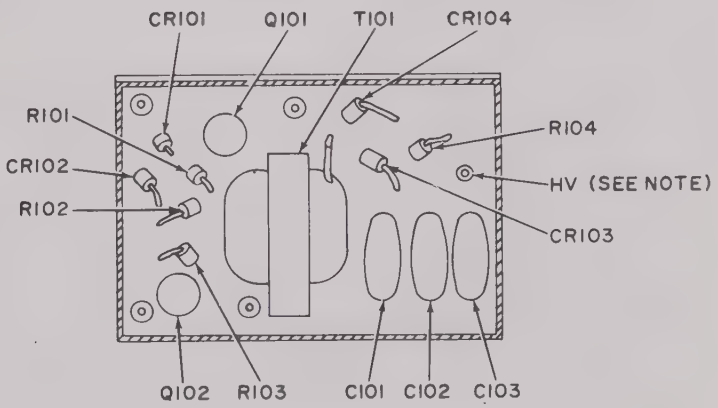


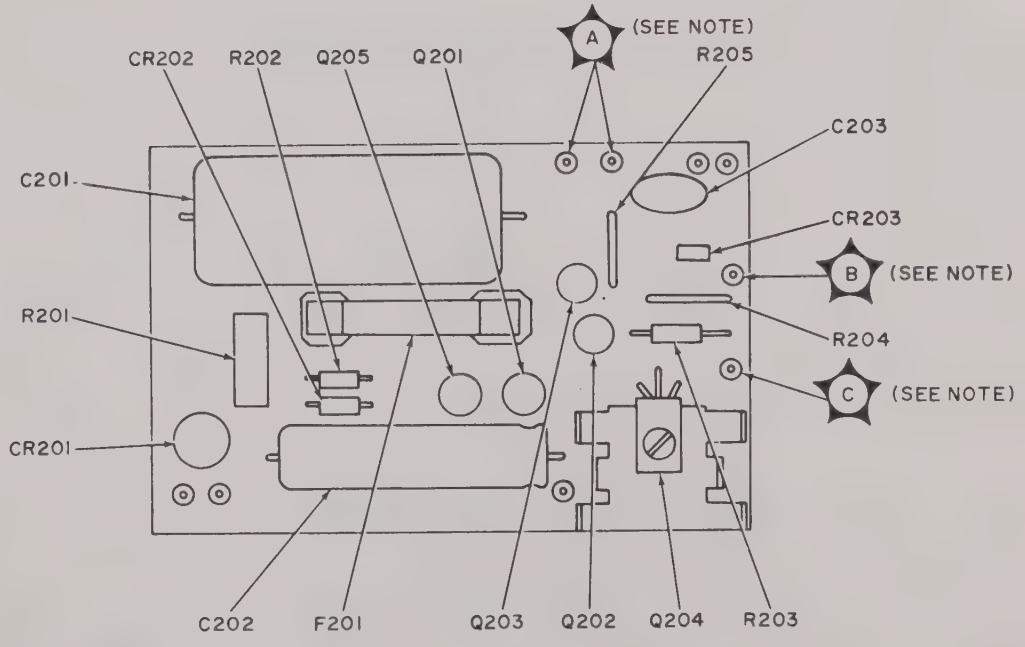
Figure 4-14. DC-DC Converter

C101, C102	06100900	. CAPACITOR: 0.01 mfd, 1000 volts	
C103	06501000	. CAPACITOR: 0.005 mfd, 3000 volts	
CR101, CR102	41100016	. DIODE: 1N461A	NB-500PA
	41100028	. DIODE: 1N461A	PA-905
CR103, CR104	41100019	. DIODE: #MR991	

DC-DC CONVERTER #10002240

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
Q101, Q102	41200006	. TRANSISTOR, NPN: Silicon 2N4074	NB-500PA
	41200064	. TRANSISTOR, NPN: Silicon MPS A06	PA-905
R101	36103006	. RESISTOR: 10 K ohms, ±10%, 1/4 watt	
R103	36391000	. RESISTOR: 390 ohms, ±10%, 1/4 watt	
R104	36333001	. RESISTOR: 33 K ohms, ±10%, 1/4 watt	
T101	44000230	. TRANSFORMER: #M-183A	

POWER SUPPLY #10002250



NOTE

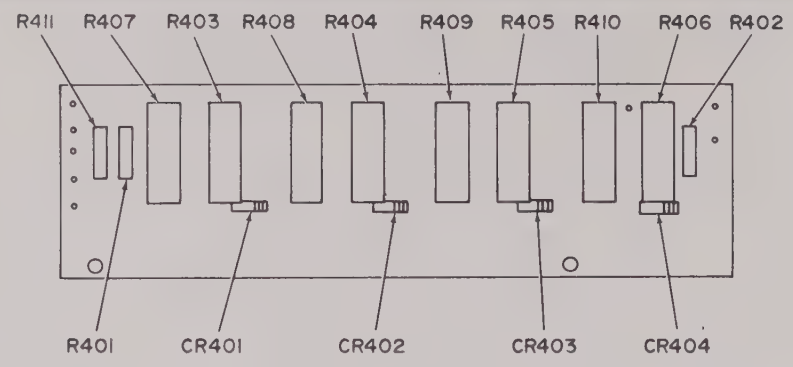
Ⓐ, Ⓑ, and Ⓒ, are arbitrarily designated test points (refer to table 3-3). These designations do not appear on the equipment.

Figure 4-15. Power Supply

C201	06500501	. CAPACITOR: 500 mfd, 25 volts	

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
C202	06200501	. CAPACITOR: 200 mfd, 25 volts	
C203	0668060(	. CAPACITOR: 68 mfd, 10 volts	
F201	31010000	. FUSE: 3 AG, 250 volts, 1.0 amp	
CR201	41100015	. RECTIFIER: Full-Wave Bridge	
CR202	41100022	. DIODE: 8 vdc, ±2%	
CR203	41100021	. DIODE: 5.6 vdc, ±2%	
R201	36101005	. RESISTOR: 100 ohms, ±10%, 1 watt	
R202	36121001	. RESISTOR: 120 ohms, ±5%, 1/4 watt	
R203	36122000	. RESISTOR: 1.2 K ohms, ±10% 1/4 watt	
R204	36232000	. RESISTOR: 2.32 K ohms, ±1%, 1/4 watt, TC=100 ppm	
R205	36332002	. RESISTOR: 3.3 K ohms, ±1%, 1/4 watt TC=100 ppm	
Q201, Q202, Q203	41200002	. TRANSISTOR: Silicon, NPN 2N3392	
Q204	41200005	. TRANSISTOR: Silicon, NPN, 2N4921	
Q205	41200004	. TRANSISTOR: Junction, Field, Effect	
	12000170	. HEAT SINK	

COMPENSATING CIRCUIT BOARD #10002340

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE
		 Figure 4-16. Compensating Circuit Board	
CR401 thru CR404	41100016	. DIODE: IN461A	NB-500PA
	41100027	. DIODE: IN461A	PA-905
R401	36153002	. RESISTOR, FIXED: 15 K ohms, ±10% 1/4 watt	
R402	36224003	. RESISTOR, FIXED: 220 K ohms, ±10%, 1/4 watt	
R403 thru R406	36503003	. RESISTOR, VARIABLE: 50 K ohms, ±20% 1/5 watt	
R407 thru R410	36103010	. RESISTOR, VARIABLE: 10 K ohms, ±20% 1/5 watt	
R411	36823001	. RESISTOR, FIXED: 82.5 K ohms, 1/4 watt, ±1%, RN55D	NB-500PA
	36683001	. RESISTOR, FIXED: 68.1 K ohm, ±1% RN55D	PA-905

PROBE ASSEMBLY #29001021 (PA-905[2])
PROBE ASSEMBLY #29001020 (NB-500PA[1])

REF. SYMBOL	MACBETH PART NO.	DESCRIPTION 1 2 3 4 5 6 7	USABLE ON CODE

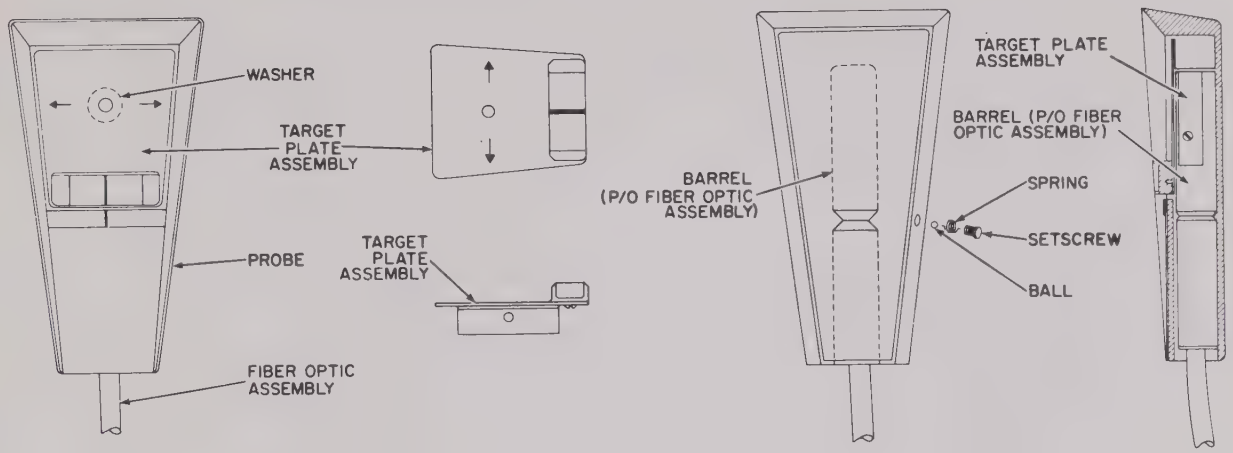


Figure 4-17. Probe Assembly

	23003621	. TARGET PLATE ASSEMBLY	PA-905
	23003620	. TARGET PLATE ASSEMBLY	NB-500PA
	29002340	. FIBER OPTIC ASSEMBLY	
	51000100	. BALL: Nylon, .156 dia.	
	50000400	. SPRING: Ball detent	
	37110200	. SETSCREW: Socket head, 10-32x1/8 long, cup Pt., with Nylok insert	

[1]Super Chromegatron I
[2]Super Chromegatron II

SECTION 5
SCHEMATIC/WIRING DIAGRAMS

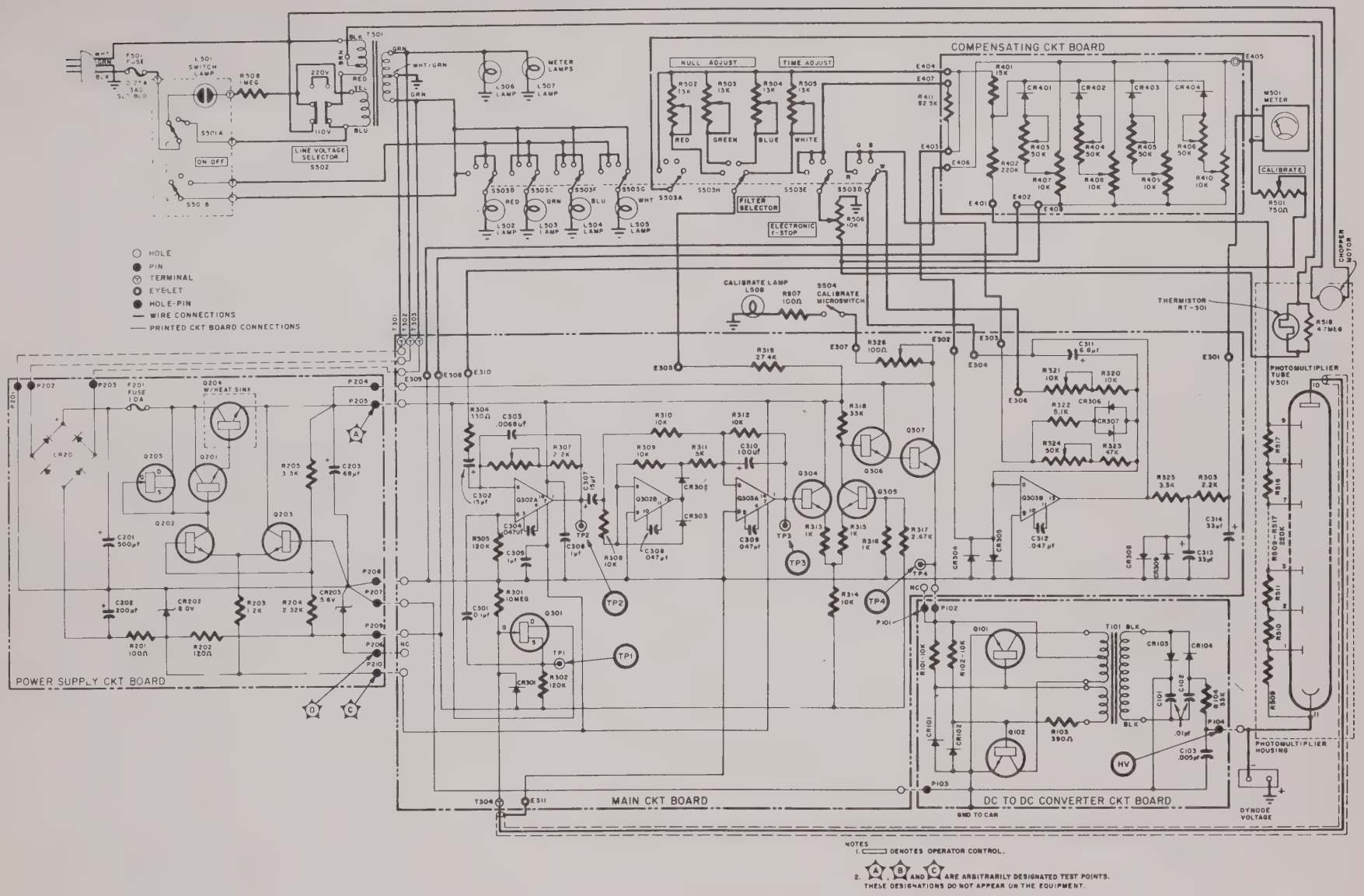


Figure 5-1. Schematic Diagram, NB-500PA (Super Chromegatron I)

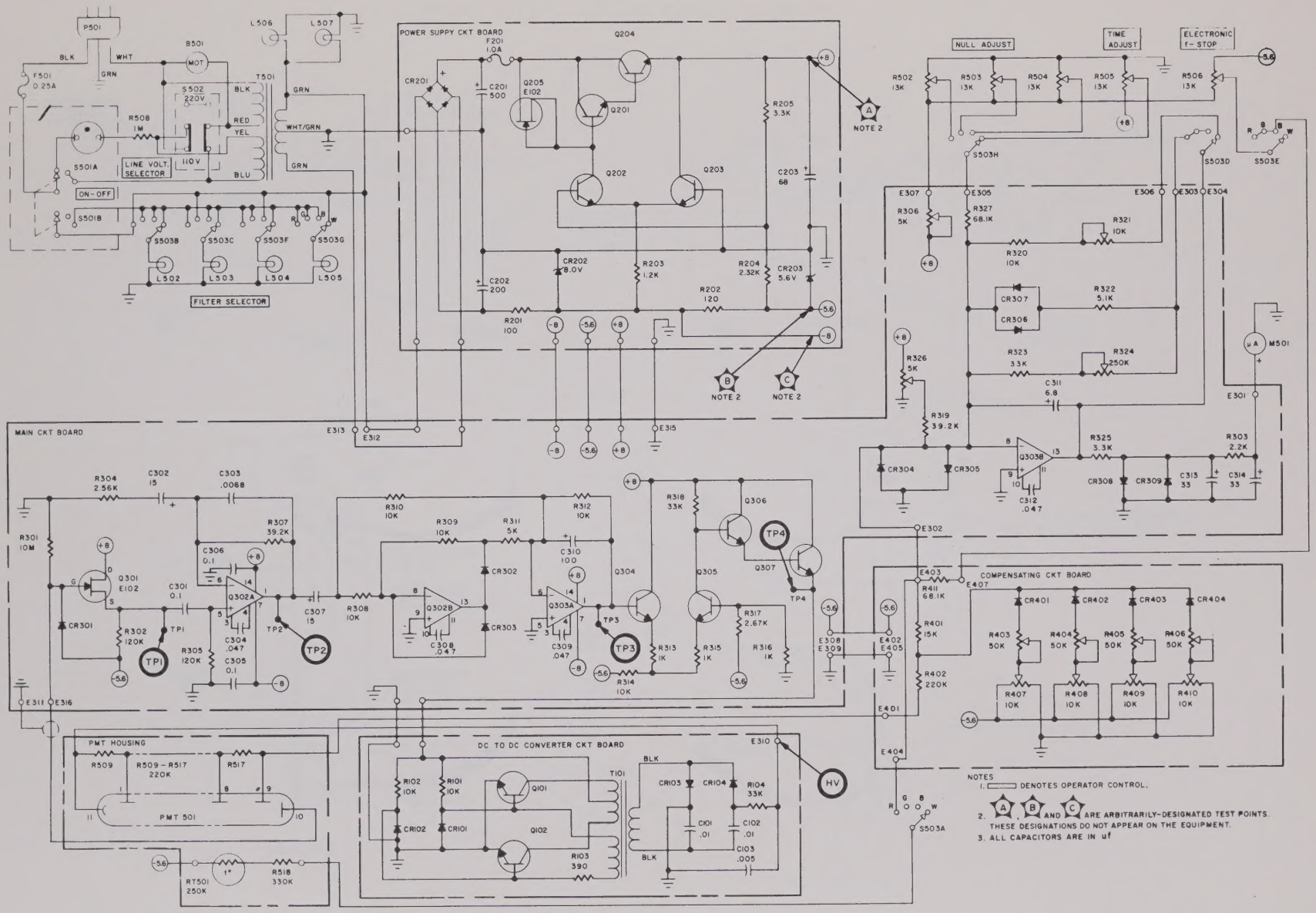


Figure 5-2. Schematic Diagram, PA-905 (Super Chromegatron II)

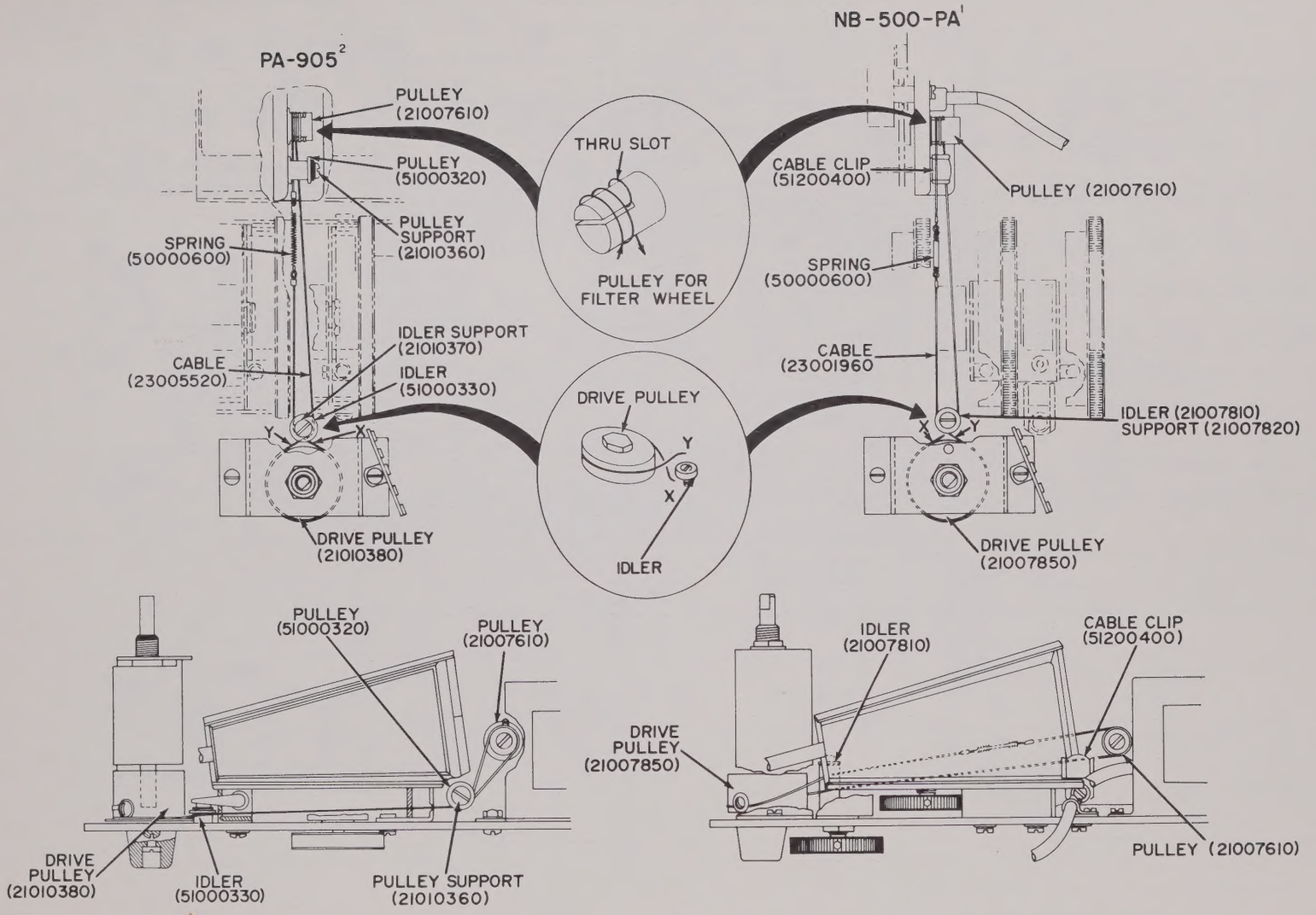
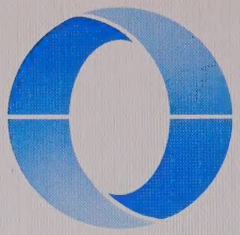


Figure 5-3. Drive Cable Scheme



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